Weather Information Communications (WINCOMM) Element Briefing

Weather Accident Prevention Annual Project Review

May 23-25, 2000

Hampton, VA

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Wx Accident Prevention Plan Genesis

WxAP - Weather Information Communications

Overview

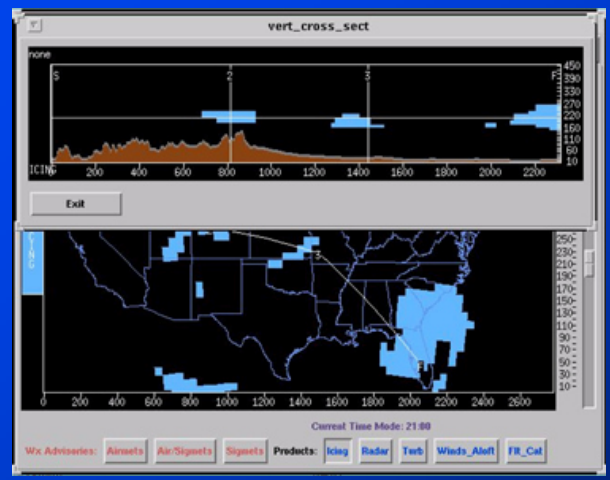
Weather is a major contributing factor in accidents

33% Commercial Carrier

27% General Aviation

ASIST Recommendations

Priority	Investment Area
1	Data Dissemination
2	Crew/Dispatch/ATC Monitoring, Presentation, and Decision Aids
3	Icing Hazard Solutions
4	Training
5	Weather Product Generation
6	Advanced Aviation Meteorology
7	Turbulence Hazard Solutions
8	Advanced Technology Vision and Tactical Sensors/Systems
9	Near Term Tactical Sensors/Systems
10	Strategic Wake Vortex Information
11	Hazard Characterization
12	Runway Contamination



Workshops/Coordination with FAA, National Aviation Weather Strategic Plan, National Weather Service, Airline Operators, Industry, etc.

Weather Accident Prevention Research Plan

Wx Accident Prevention Plan Genesis

National Aviation Weather Program Council develops the *National Aviation Weather Initiatives* document, identifying the following high impact initiatives:

1) Implement data link capabilities for Flight Information Services (FIS).
2) Develop and implement multifunctional color cockpit displays incorporating FIS products.
3) Expand and institutionalize the generation, dissemination, and use of automated pilot report to the full spectrum of the aviation community, including general aviation.
4) Improve underlying weather forecasting services.
5) Require, develop, and implement aviation weather-related training packages for users.
6) Improve aviation weather information telecommunications capabilities for ground-ground dissemination of aviation weather products.
7) Establish objective standards for characterizing various weather phenomena for national and international use.

WxAP Goals, Objectives & Projects

Goal

Develop enabling technologies to reduce weather-related causal factors to accidents by 50% and eliminate turbulence injuries by 90% by year 2007

Objectives

- Provide the Flight Deck, ATM & AOC with Higher Fidelity, More Timely, Intuitive Graphical Information
- Enhance Situational Awareness in Reduced Visibility
- Detect and Mitigate Weather Hazards

Challenges

- Multi-Purpose Sensor Systems and Displays
- Real-Time Datalink Communication
- Weather-related Threat Characterization

Approaches

- Improve Weather Forecast and Nowcast Capabilities
- Revolutionize Aircraft/Ground, and Aircraft/Aircraft Information Exchange
- Use Aircraft as Airborne Weather Data Collectors

Projects

- Aviation Weather Information
- Weather Information Communication
- Turbulence Detection & Mitigation

WINCOMM Project Goal & Objectives

- **WINCOMM Project Goal:**

  Develop advanced communications and information technologies, with supporting standards definition, to enable the high quality and timely dissemination of aviation weather information to all relevant users on the global aviation network.

- **WINCOMM Project Objectives:**

  1) **Develop advanced communications/information technologies to enable the efficient and timely dissemination of high quality, accurate aviation weather information to all relevant users on the aviation information network; addressing:**
     - **Airborne and ground-base users**
     - **National and worldwide access/connectivity**
     - **Cross-segment operations**
  2) **Develop advanced communications systems, supported by network system modeling, and support appropriate communications standards and protocols definition to ensure/enable the efficient implementation of advanced weather products.**

System Elements

AWIN
Enhanced Weather Products

WINCOMM
Communications Networks and Data Links

AWIN
Operator Support

Weather Information Exchange

WxAP - Weather Information Communications

Overview

Text Printout of Convective SIGMET

```
MKCC WST 221355
CONVECTIVE SIGMET 49C
VALID UNTIL 1555Z
IL IN KY
FROM IND-30SSW LOZ-60ESE FAM-IND
AREA TS MOV FROM 30030KT. TOPS ABV FL450.
CONVECTIVE SIGMET 50C
VALID UNTIL 1555Z
IL MO
FROM 20N BRL-40N DEC-50NE FAM-30N VIH-20N BRL
AREA SEV TS MOV FROM 29035KT. TOPS ABV FL450.
HAIL TO 1 IN...WIND GUSTS TO 50 KT POSS.
OUTLOOK VALID 221555-221955
FROM ORD-EKN-CLT-DYR-SGF-MKC-DSM-CID-ORD
TS CONTG TO MOVE THRU MID MS VLY/LWR OHIO VLY. AMS ALG/S OF
QSTNRY SFC FNTL BNDRY THRU CNTRL PLAINS SE TO NC CST RMNS
MOIST
AND UNSTABLE. S-SWLY FLOW AT LOW LVLS INTSECTG BDRY OVR MID
MIS
AND LWR OHIO VLYL HELPING TO MAINTAIN TS ACT. SOME WKNG
PSBL...HOWEVER...EXP NEW DVLPMNT IN THE 15Z TO 18Z HRS.
RFM
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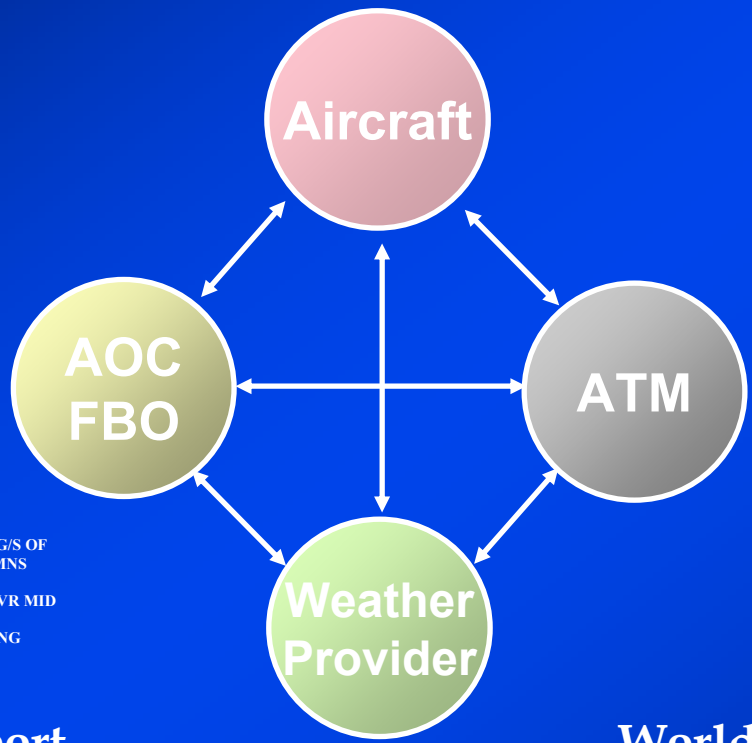
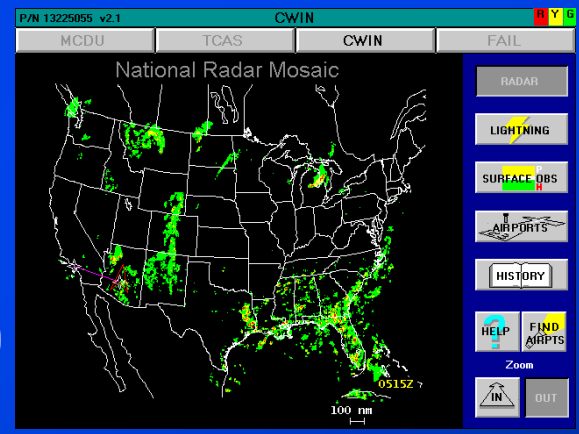
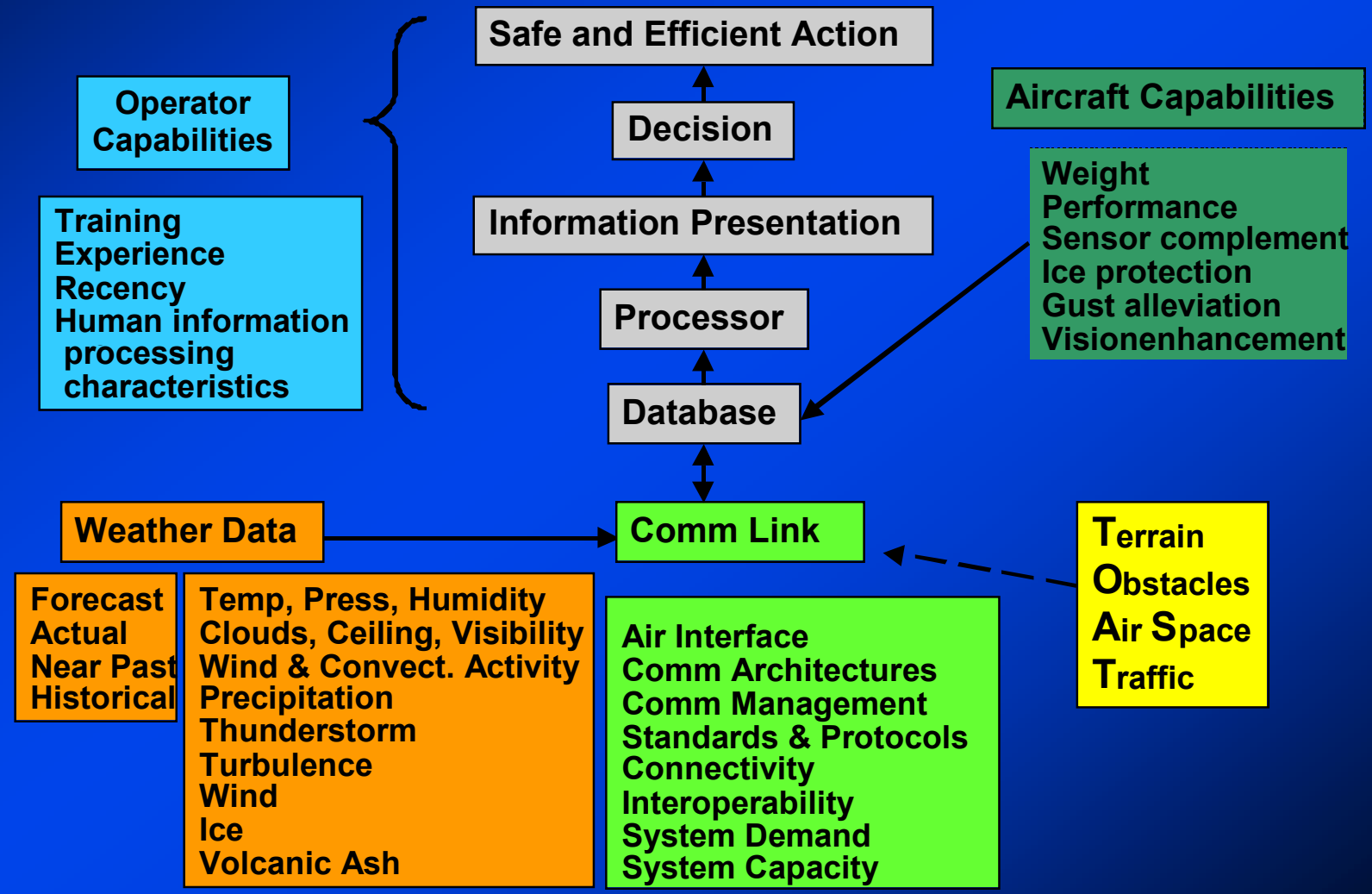




Graphical Presentation

- Transport — Worldwide
- Commuter — United States
- General Aviation — United States
- Air Traffic Management (ATM) — United States +
- Airline Operations Center (AOC) — Worldwide
- Fixed Base Operator (FBO) — United States

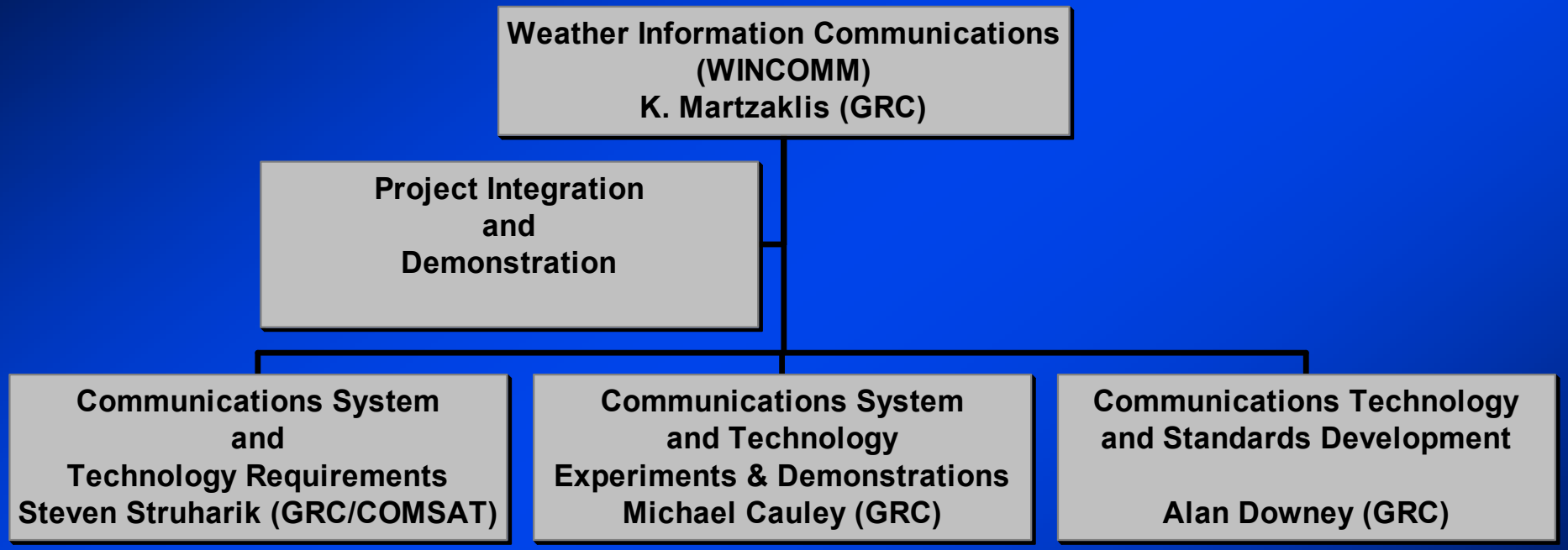
Decision Process & AWIN System



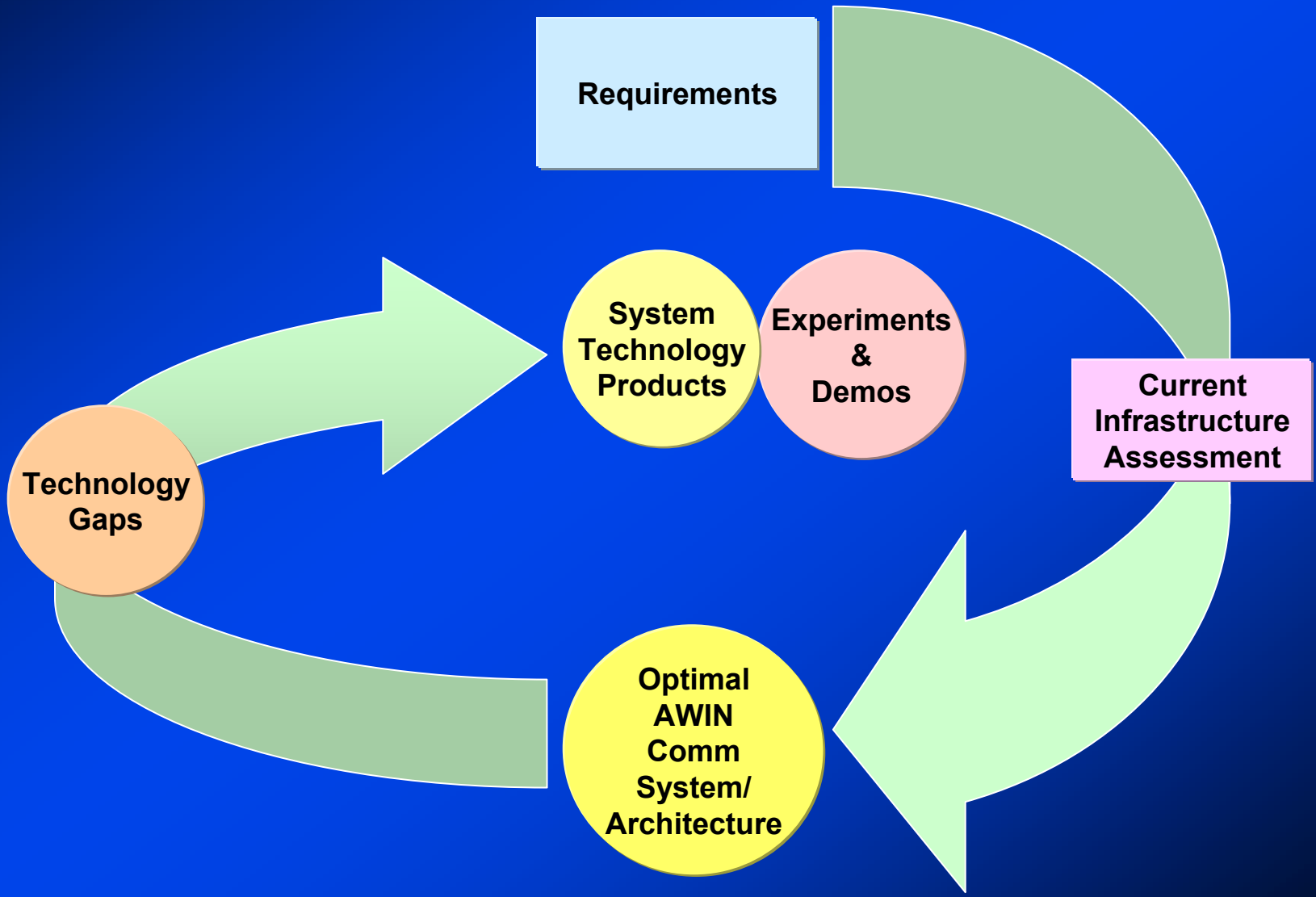
Cooperative Research Efforts

- National Airline / Transport and World-Wide Weather Information Systems
  - Boeing — Aviation Weather Information (AWIN)
  - Honeywell — Weather Information Network (WINN)
  - Rockwell Collins — Satellite Weather Information System (SWIS)
- National General Aviation Weather Information Systems
  - ARNAV — Weather Hazard Information System: Reducing GA Fatal Weather-Related Accidents
  - Honeywell — GA-Oriented VHF DataLink (VDL) Mode 2-Based Weather and Flight Information Services (FIS) Broadcast, Reception, and Display System
- Topical Category
  - Honeywell — Weather Avoidance Using Route Optimization as a Decision Aid
  - Honeywell — General Aviation Oriented Electronic Pilot Report (EPIREP) Generation and Datalink System
  - Rockwell — Aviation Weather Awareness and Reporting Enhancements (AWARE)
  - Rockwell — Enhanced On-Board Weather Information System
  - NCAR — A Demonstration of an End-to-end Oceanic Weather Hazard Information Dissemination System
  - NRL — Ceiling and Visibility

WINCOMM Project Organization



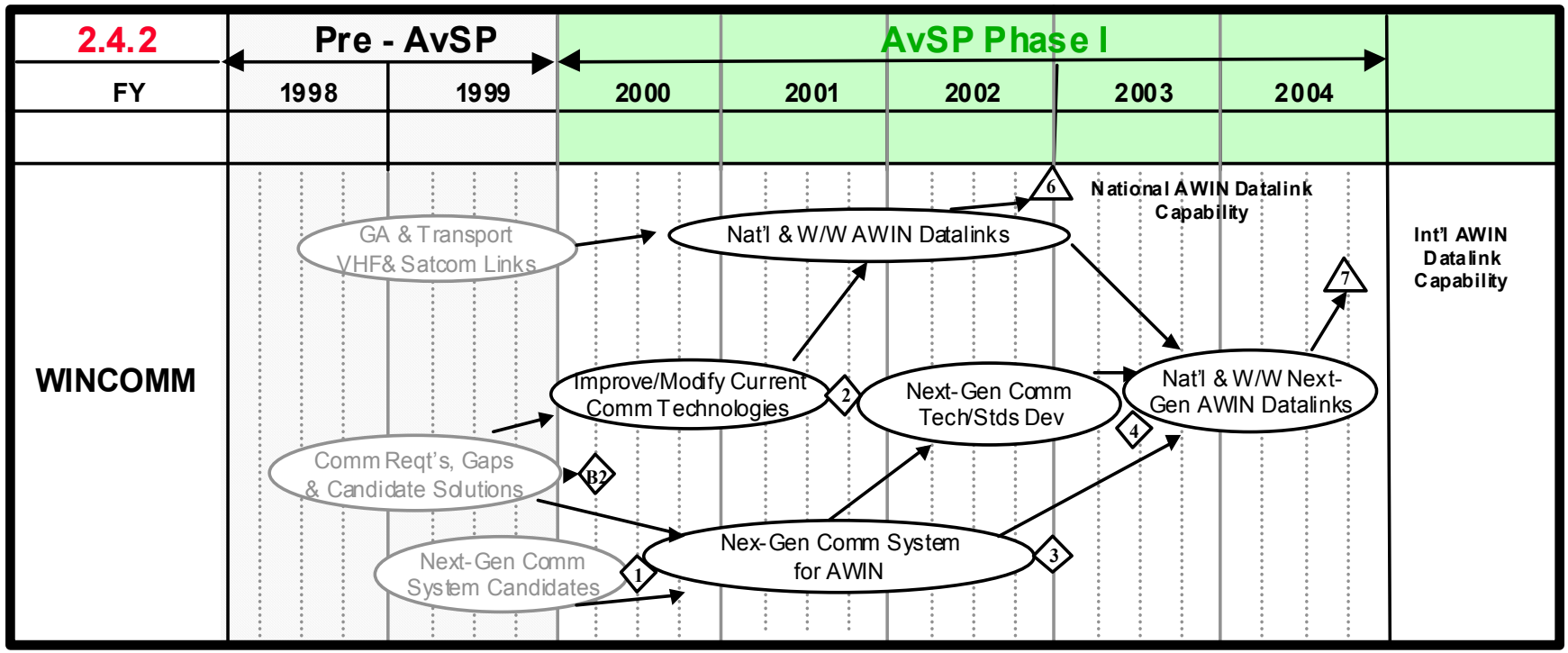
Technical Approach



Project Level III Roadmap(*)

WxAP - Weather Information Communications

Overview



Level II and Level III Milestones(*)

Relevant Level II Milestones:

6) *National AWIN Datalink Capability (4QFY02)*: **Flight evaluation of initial national capability for digital datalink for graphical display of weather information.**

7) *International AWIN Datalink Capability (3QFY04):* **Flight evaluation of initial international capability for digital datalink for graphical display of weather information.**

Level III Milestones:

B2) *Definition of AWIN Communications Reqt's (1QFY00)*: **ID communications requirements of current and projected future Wx products and tools.**

1) *Next Generation AWIN Comm System Candidates (2QFY00):* **Select and define from candidate pool next-generation communications system addressing timely, accurate dissemination of high quality, intuitive Wx information.**

Level II and Level III Milestones(*)

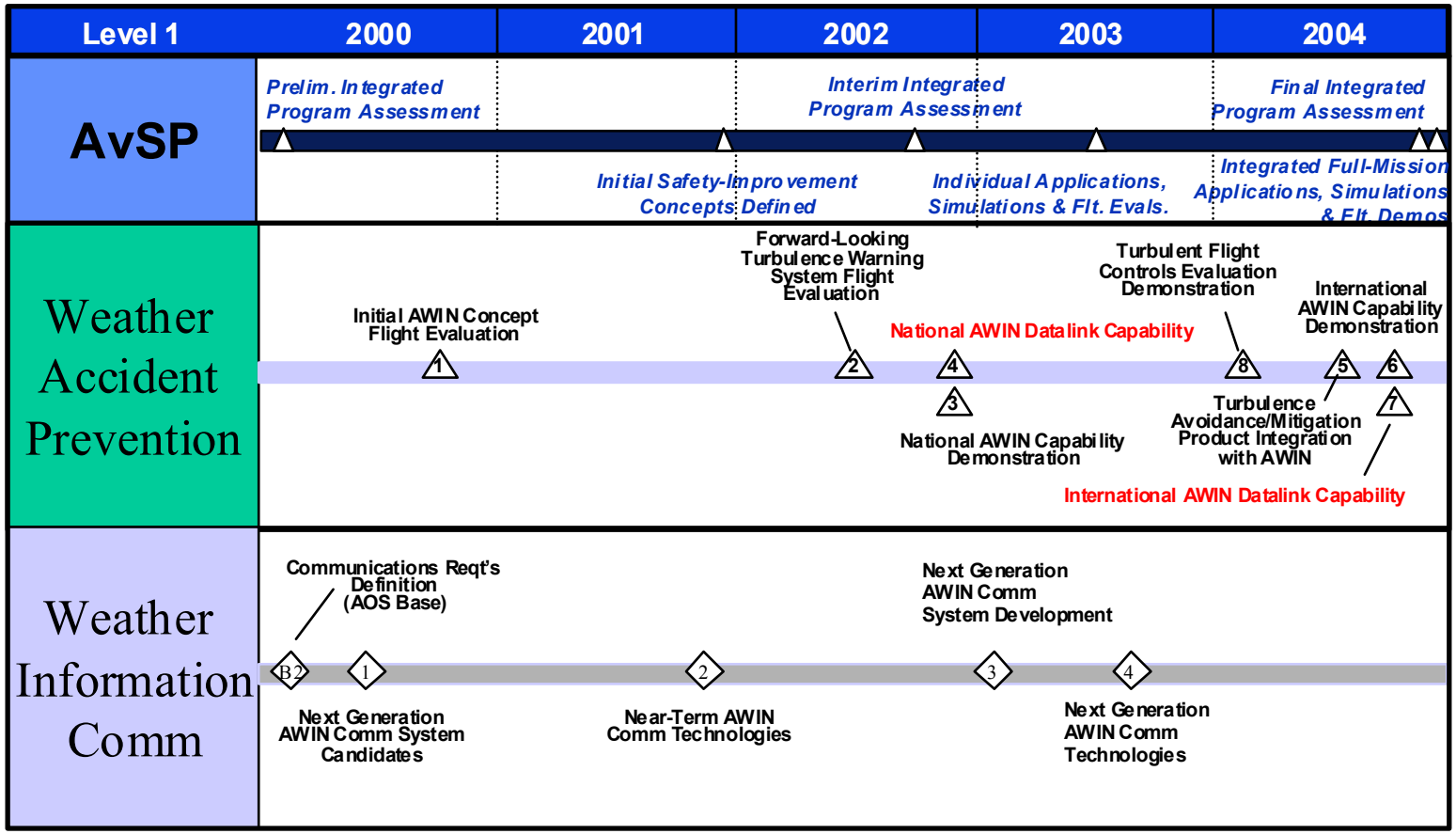
Level III Milestones (continued):

2) *Near-term AWIN Comm Technologies (3QFY01)*: **Completion of development of near-term communications technologies for AWIN dissemination .**

3) *Next Generation AWIN Comm System Development (4QFY02):* **Complete development of the next generation communications system for AWIN.**

4) *Next Generation AWIN Comm Technologies (2QFY03):* **Complete development of the next generation communications technologies for AWIN dissemination.**

Milestone Schedule(*)



System Issues

Utilization
- Civil Transport
- General Aviation
- Military

Service Provider
- FAA
- Other Government
- Public / Private Commercial

Avionics Issues
- Equipage / Avionics Cost
- Applicability Across Platforms
- Mandatory/Primary/Optional
- Architecture - OSA / Proprietary
- Level of Integration

Link Characteristics
- Spectrum / Frequency
- Bandwidth
- Modulation
- Access Technique

Quality-of-Service
- Timeliness/Latency
- Priority
- Availability
- Redundancy
- Robustness

Delivery
- Voice/Data
- Simplex/Duplex
- Broadcast
- Line-of-sight
- Over-the-Horizon

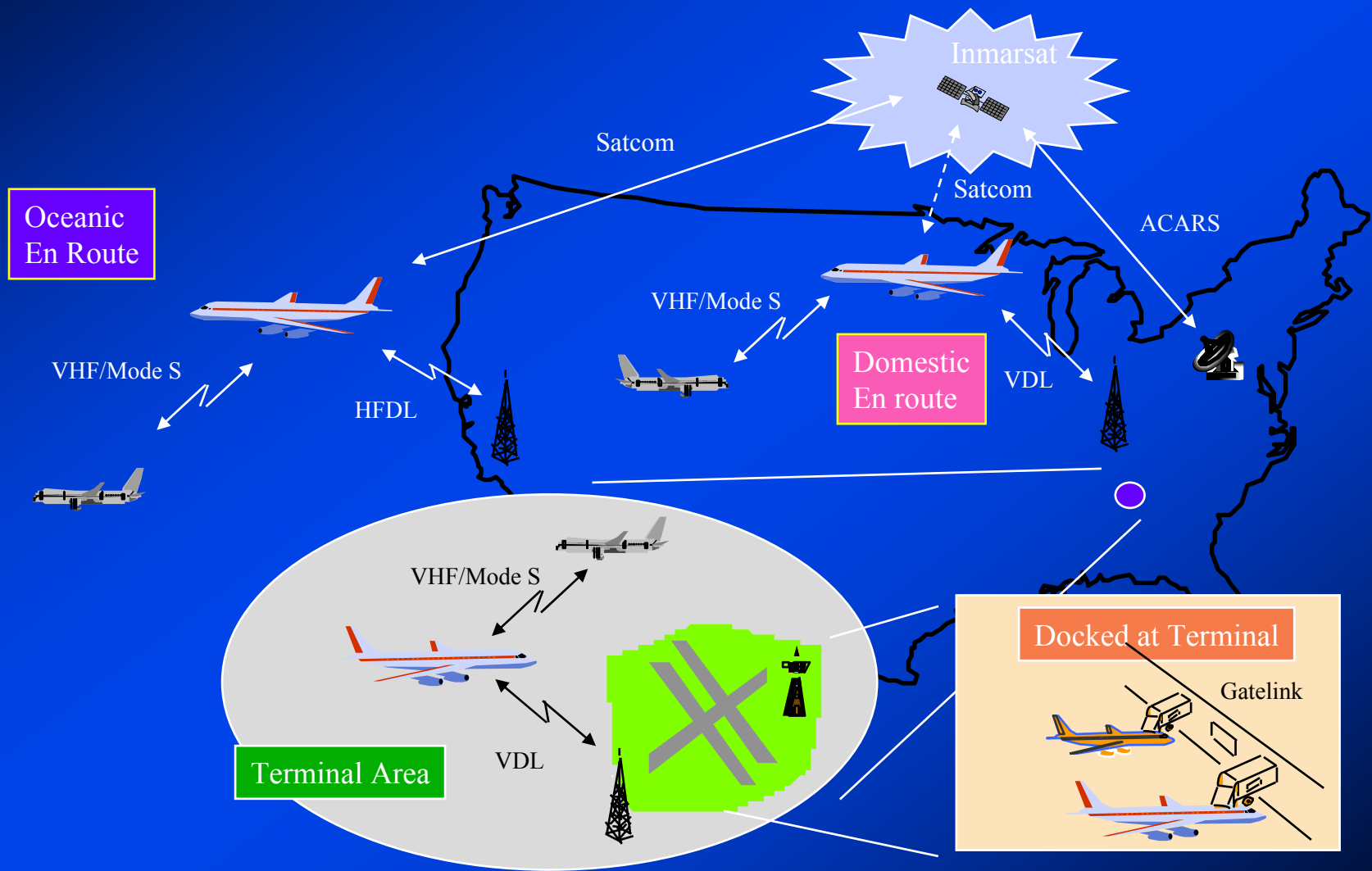
Phase-of-Flight
- Planning
- Surface Movement
- Terminal Operations
- En Route / Oceanic

Coverage
- Global
- Regional
- Oceanic
- Line-of-Sight

Communications Subnetworks

- Analog Voice
- ACARS
- VHF Datalink (VDL Modes 2-4, Broadcast)
- HFDL
- UAT
- SatCom (AMSS, NGSS, SDARS)
- Mode S
- Gatelink

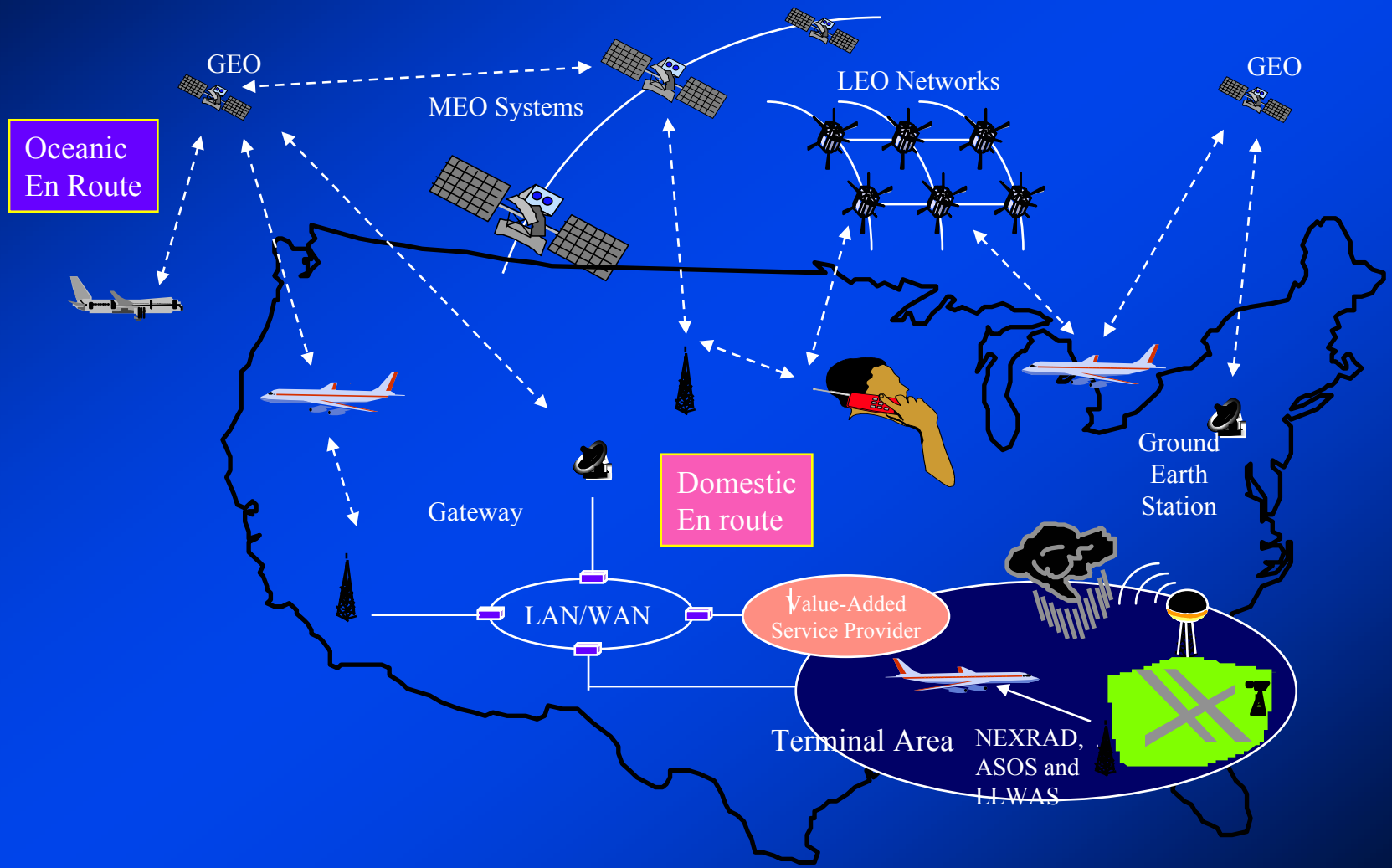
Traditional & Near-Term Comm



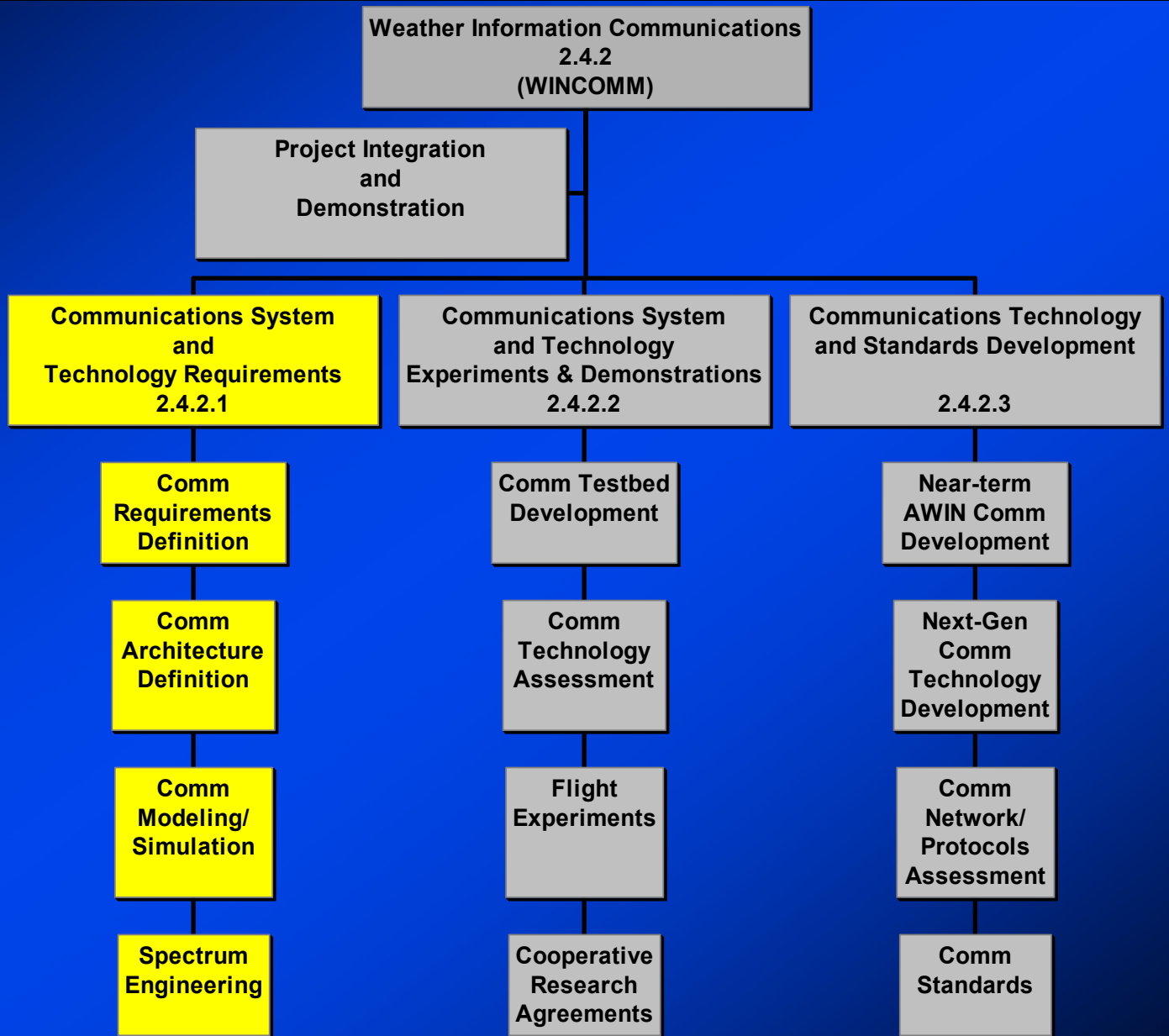
Non-Traditional Comm

WxAP - Weather Information Communications

Overview

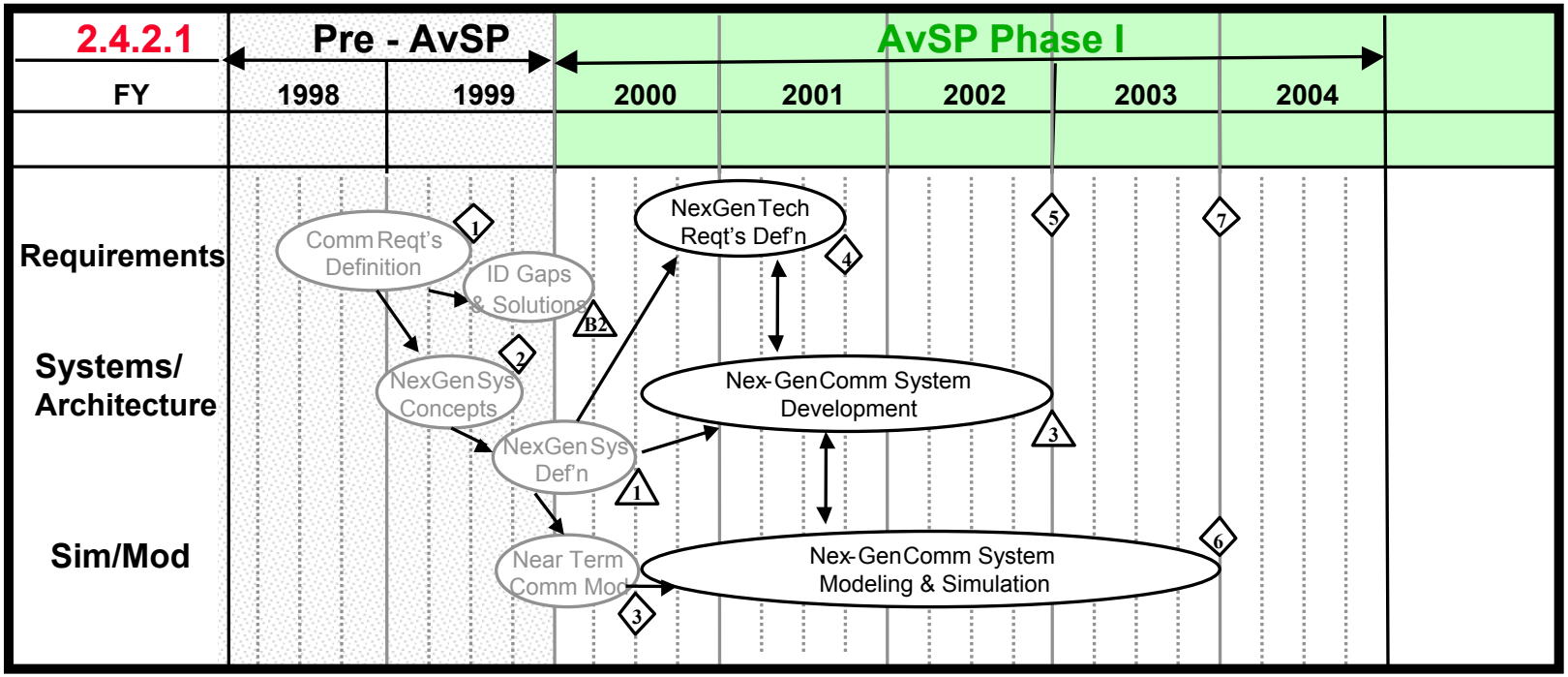


Work Breakdown Structure



Level IV Roadmap

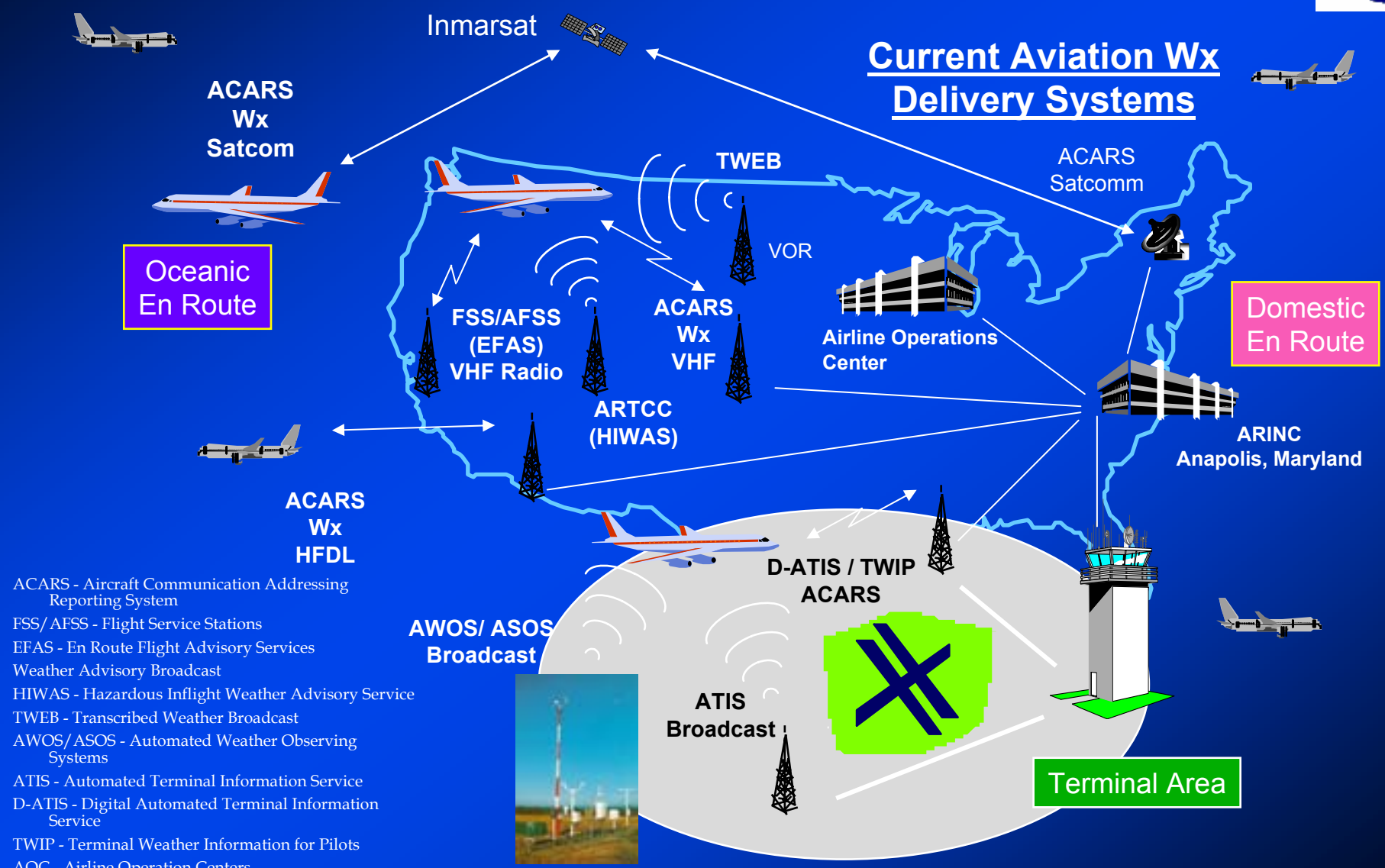
2.4.2.1 Comm System & Technology Requirements



Requirements Definition

- Overall Goal/Objectives:
  - Define the communications requirements for Wx dissemination.
  - Assess current comm infrastructure and its ability to support current & future Wx products.
- Implementation Mechanism:
  - Contract study by Lockheed Martin Aeronautics Company
    - Phase I (9/98 - 4/99): Weather Tools and Requirements
    - Phase II (8/99 - 3/00): Communications Gaps & Technical Solutions
- Technical Results to Date:
  - Aviation Wx comm requirements defined
  - Emerging aviation datalinks evaluated for Wx; deficiencies identified
  - Non-aviation comm systems investigated for aviation Wx
  - Needed technology identified; research areas recommended
  - Results being integrated with other sources to assess next generation comm technology requirements
- Future Plans:
  - Integrate results with requirements from other industry studies
  - Develop comm requirements for EPIREPS in conjunction with aviation community and FAA
  - Update requirements yearly

Requirements Definition



ACARS - Aircraft Communication Addressing Reporting System
FSS/ AFSS - Flight Service Stations
EFAS - En Route Flight Advisory Services
Weather Advisory Broadcast
HIWAS - Hazardous Inflight Weather Advisory Service
TWEB - Transcribed Weather Broadcast
AWOS/ ASOS - Automated Weather Observing Systems
ATIS - Automated Terminal Information Service
D-ATIS - Digital Automated Terminal Information Service
TWIP - Terminal Weather Information for Pilots
AOC - Airline Operation Centers

Communications Architecture

- Overall Goal/Objective:
  - Identify optimal next-generation Wx communications architecture/system(s) for 2007 and through 2015, with supporting analyses, that enable timely, accurate dissemination of high quality, intuitive weather information.
- Implementation Mechanism:
  - Contract study by SAIC (lead), with support of TRW, ARINC & Crown Consulting, with periodic in-house review and consultation by NASA (April 1999 - May 2000)
  - Milestones:
    - 2007 Comm Architecture Definition
    - Annual Updates to Architecture Definition/Next-Generation Communications Technology Requirements
  - Results flow into related areas:
    - Modeling and Simulation
    - Technology Development
    - Protocols and Standards

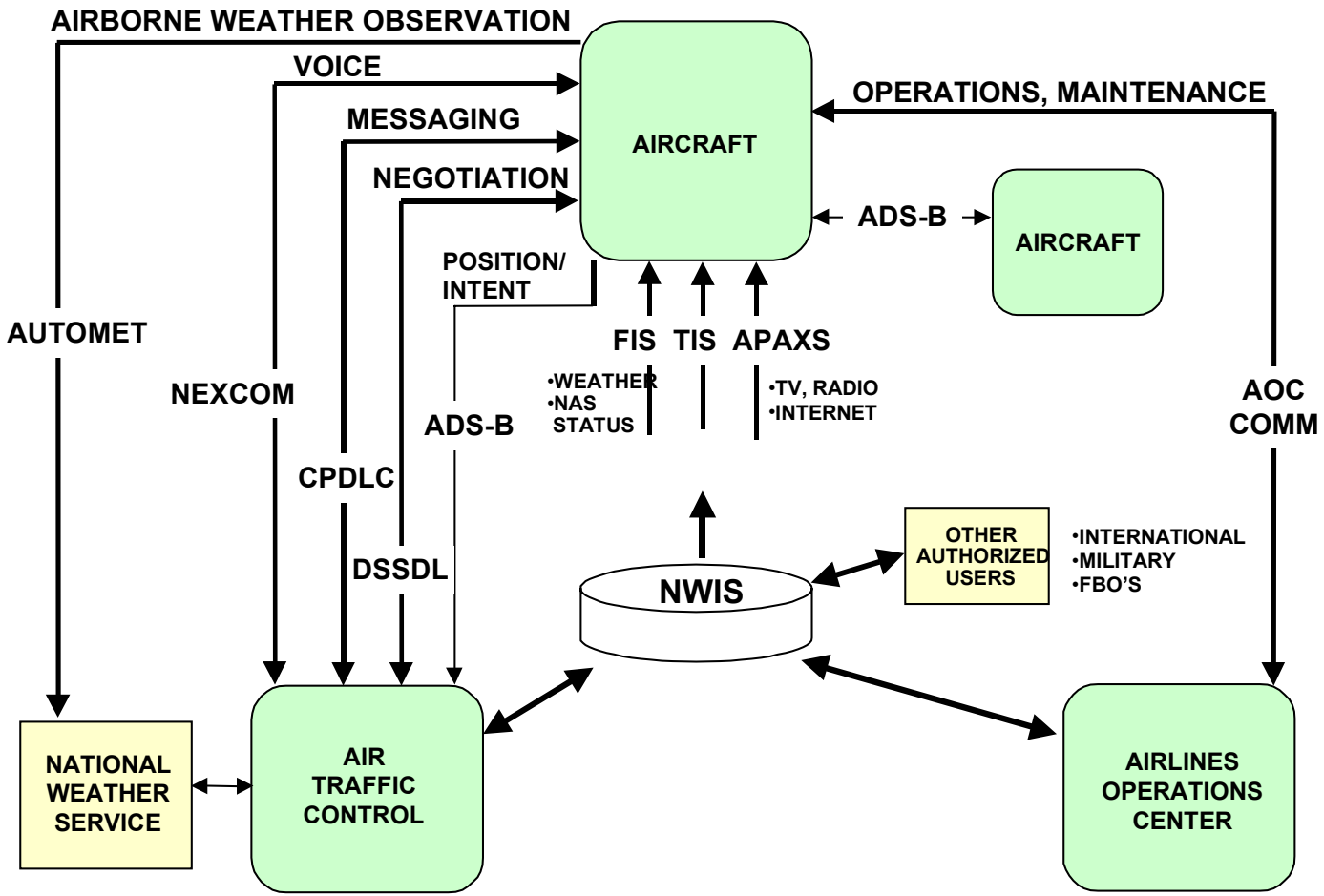
Communications Architecture

- Technical Results to Date:
  - Architecture Report completed. Broad scope addresses several Tasks:
    - NAS Architecture 4.0 used as baseline
    - Multiple alternative architectures considered
    - 2007 Architecture (deliverable)
    - 2015 Architecture (deliverable)
    - Basis for Analyses
    - Comm System/Technology Gaps
  - Several other studies and reports in related areas
- Future Plans:
  - Integrate results with other industry studies
  - Hardware & software simulation and flight experiments to validate architecture
  - Update architecture yearly

Functional Communications Architecture

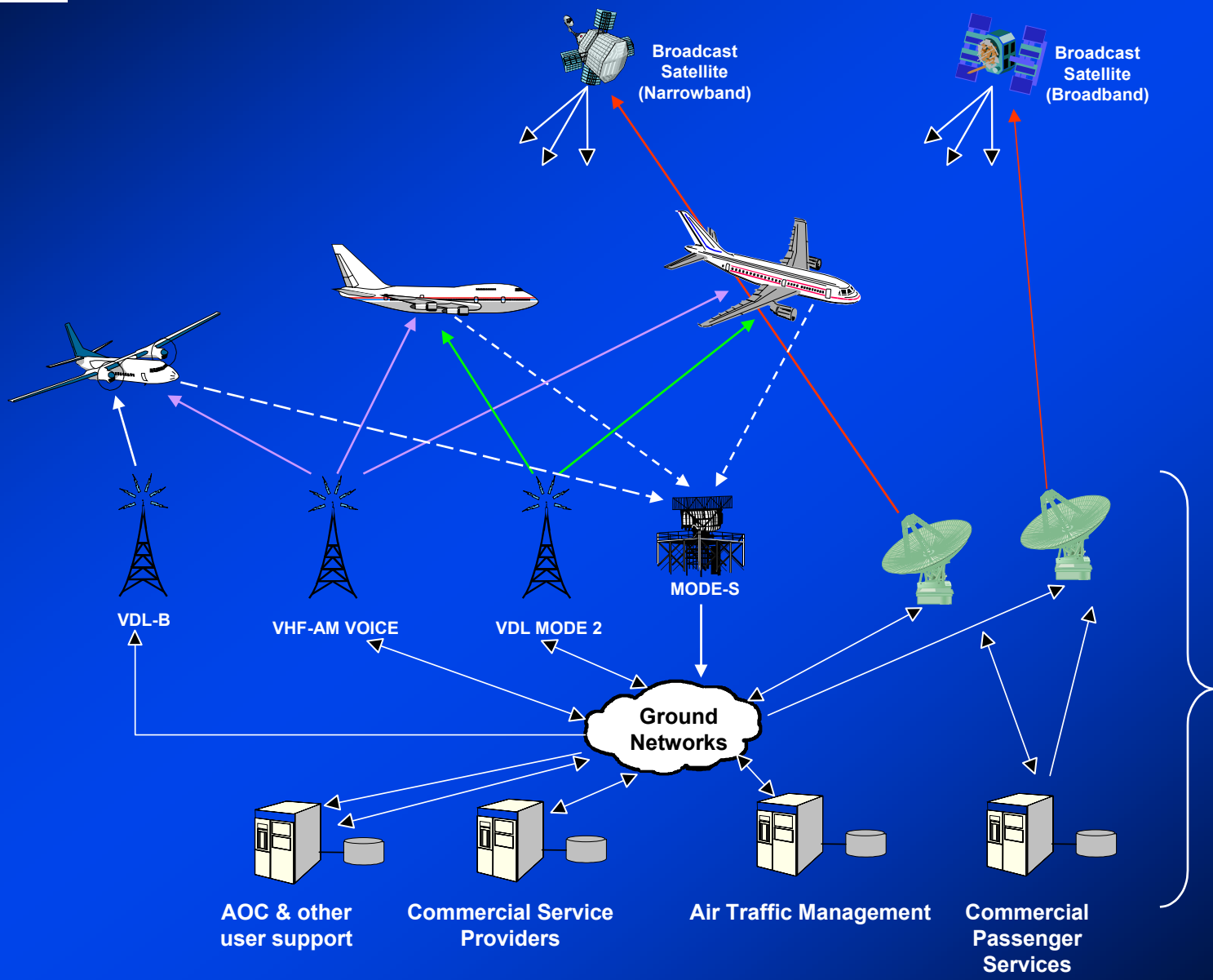
WxAP - Weather Information Communications

Requirements



Communications Architecture

WxAP - Weather Information Communications Requirements



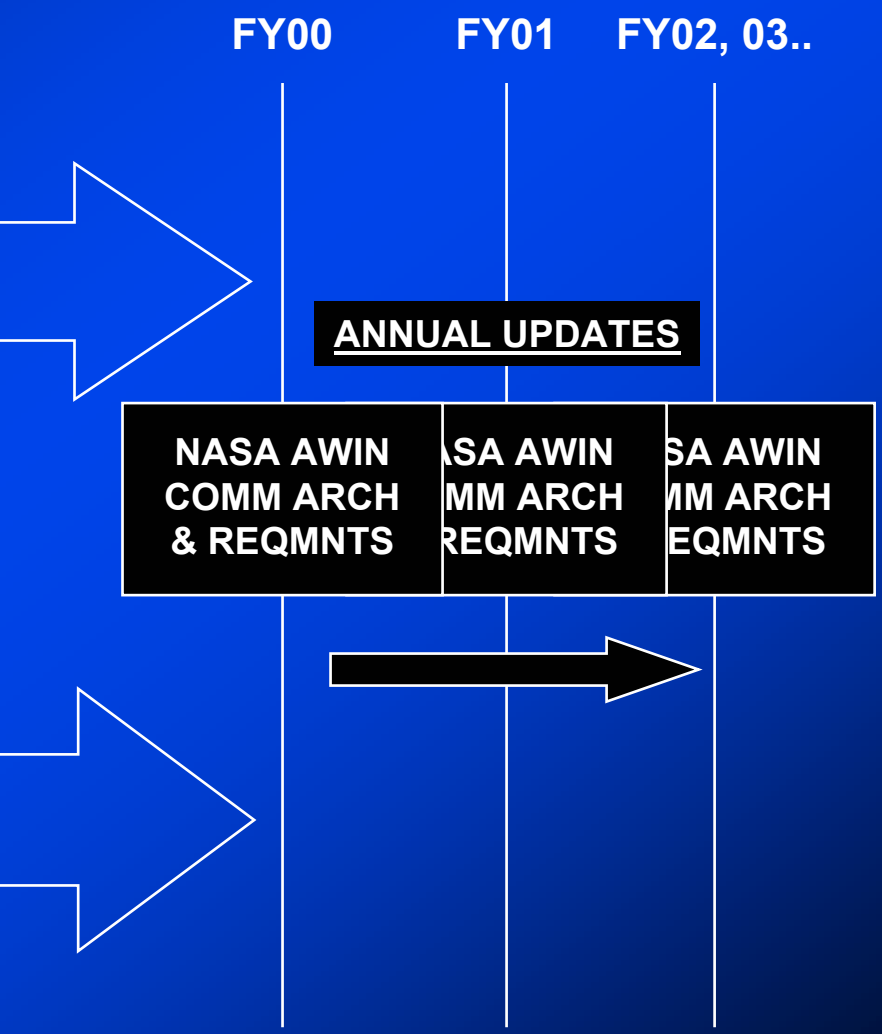
Comm Requirements & Architecture Synthesis

REQUIREMENTS

- LM Phase1 & Phase 2 Reports
- AWIN CRA Phase I Reports
- G/A EPIREPS Requirements
- AWIN Wx Products Requirements
- Other Industry Inputs
- FAA Inputs
- In-House Expertise

ARCHITECTURE

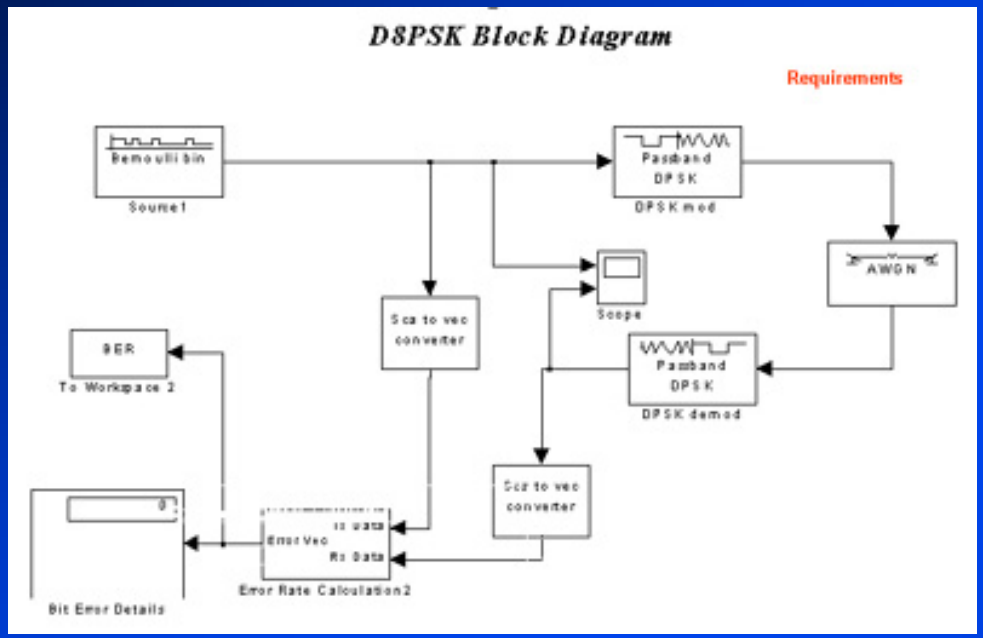
- FAA NAS 4.0 (Baseline)
- SAIC, et al, 2007, 2015 Architectures
- Other Industry Inputs
- FAA Inputs
- In-House Expertise

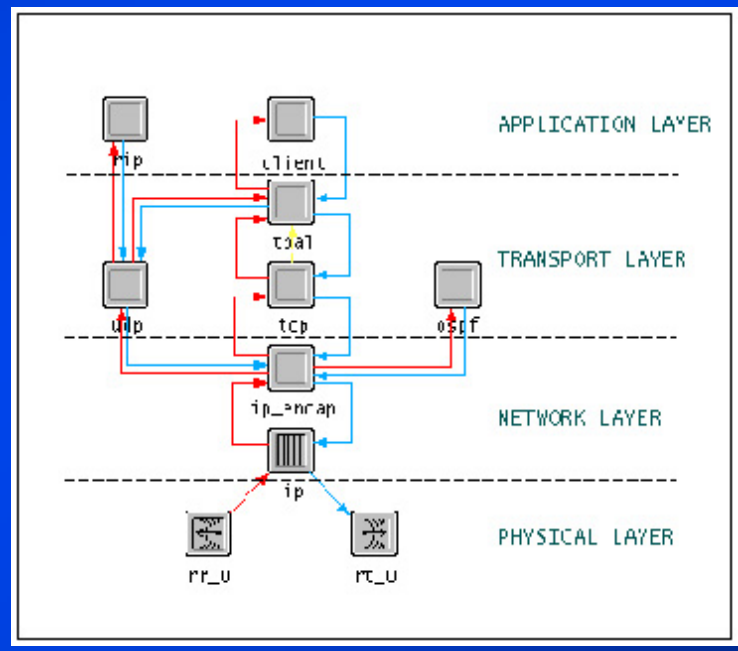


Simulation and Modeling

- Overall Goal/Objective:
  - Develop software simulation/emulation capability for modeling and verification of communications architecture and requirements
- Implementation Mechanism:
  - In-house effort initiated 1QFY00
  - Cooperative with other parallel in-house efforts
  - Develop near-term comm data link models
- Technical Results to Date:
  - Software tools (MATLAB/SIMULINK, OPNET, STK) identified & acquired
  - Modeling in progress
  - Defining overall simulation configuration and process
  - Acquiring link parameters for incorporation into models
- Future Plans:
  - Develop full scale simulation capability - multiple aircraft/multiple ground nodes/hybrid networks and links - from physical layer to network and transport layers - using models of current and projected comm sys & datalinks
  - Develop multi-terminal emulation for use with hardware simulation test bed
  - Use with hardware simulation and flight experiments to validate comm concepts

Simulation and Modeling





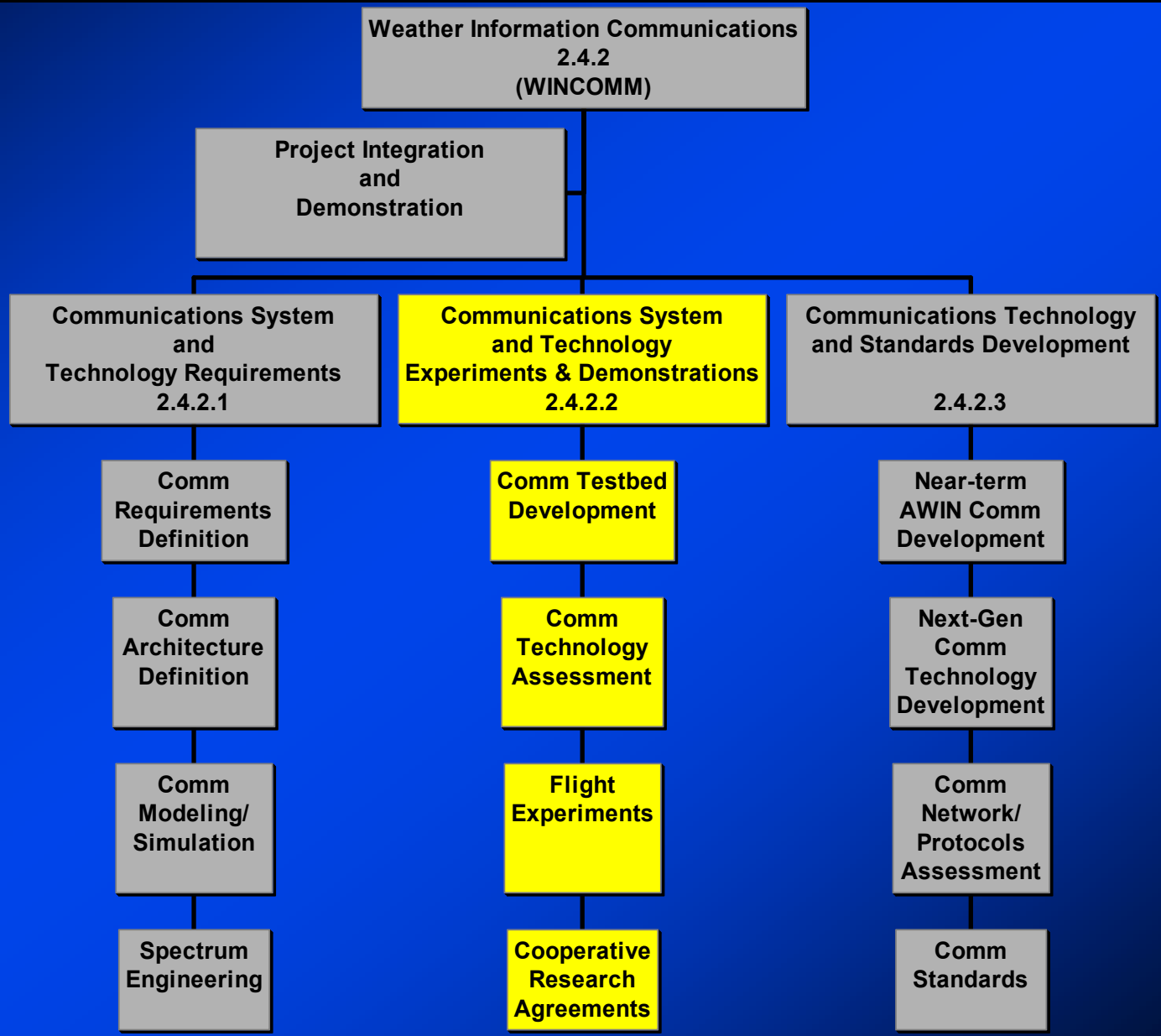
Software System Simulation

Comm Link Models (MATLAB/SIMULINK) ⇒ Network Simulation (OPNET)

Laboratory System Simulation
Hardware Link (Test Bed)
+ Traffic Emulation (OPNET)

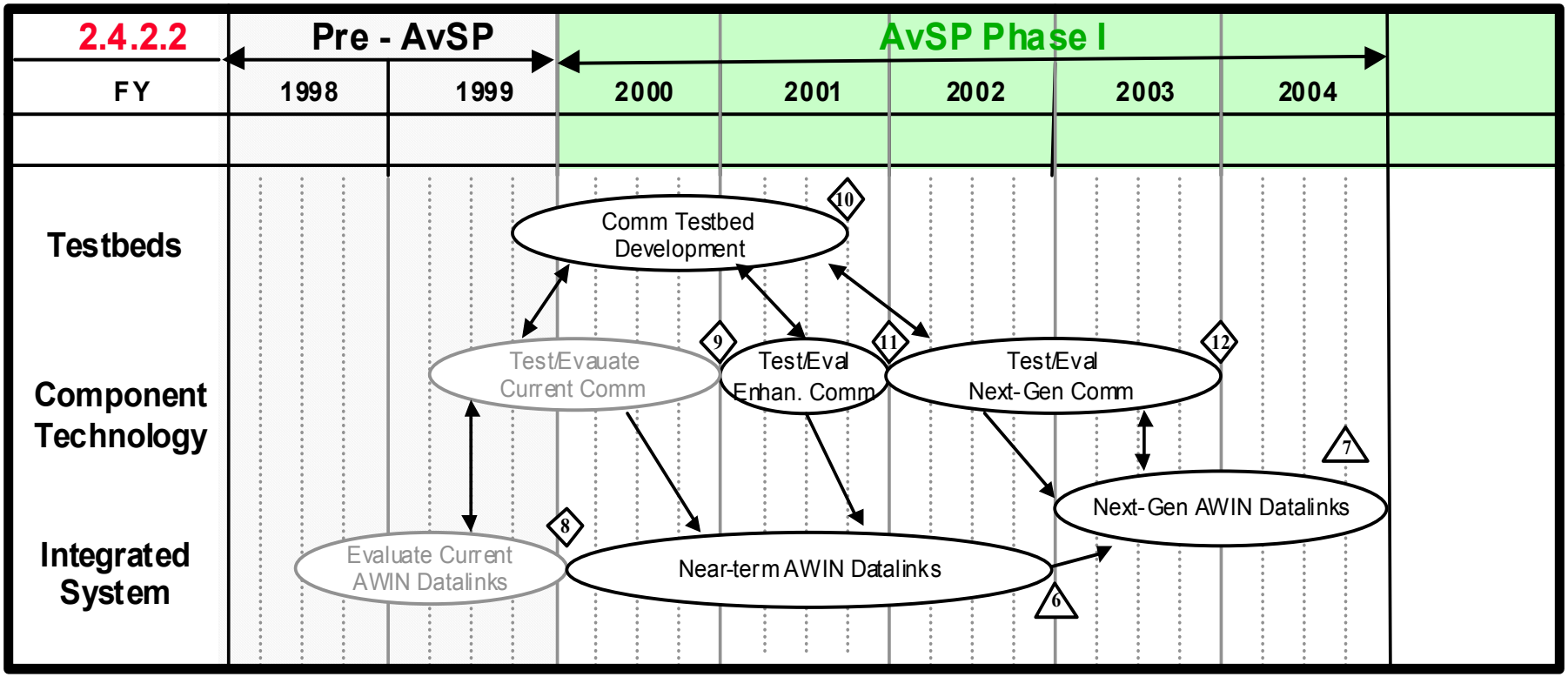
⇒ Flight Experiments ⇒ **Validation of Architecture and Technical Concepts**

Work Breakdown Structure



Level IV Roadmap

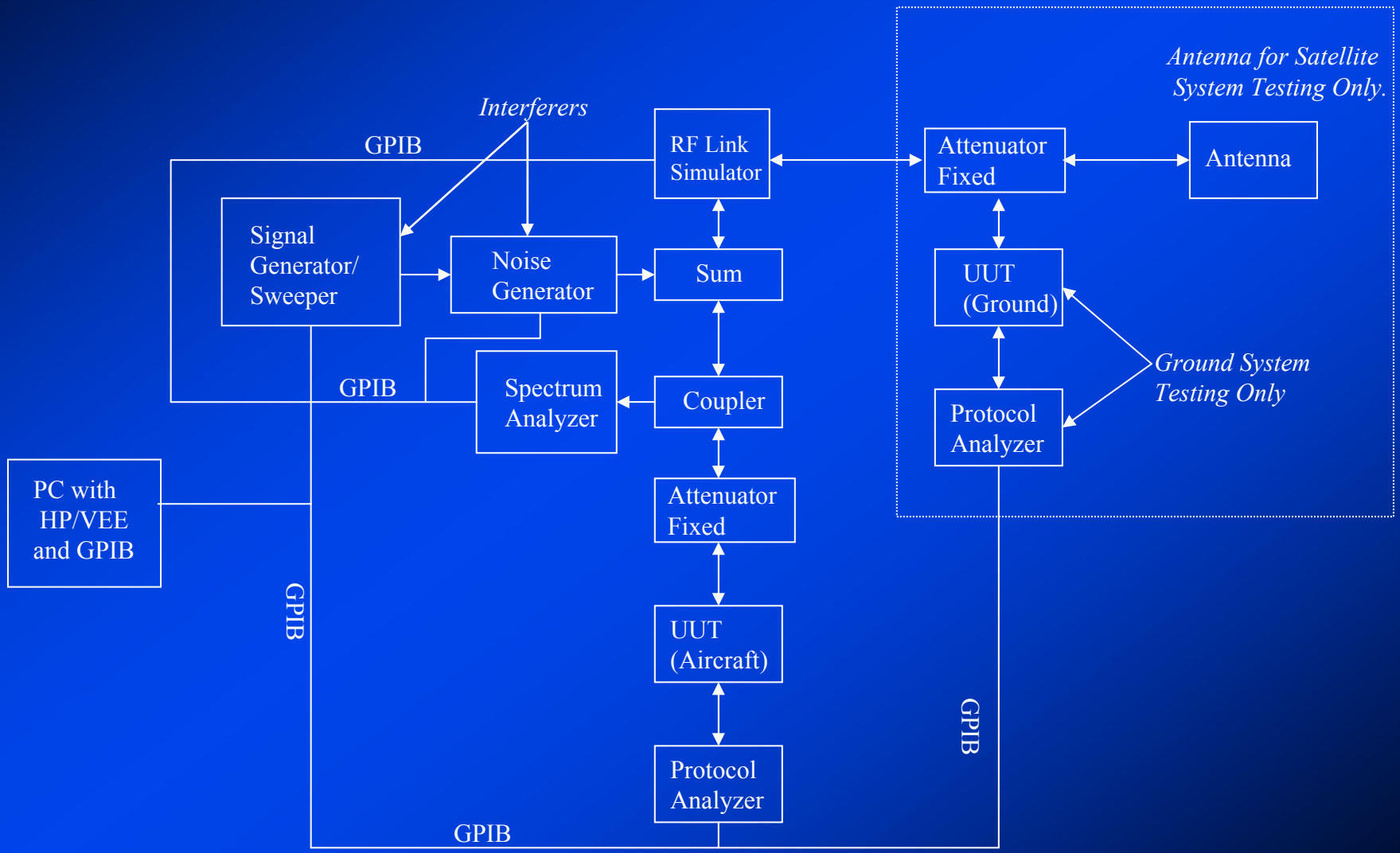
2.4.2.2 Comm System & Technology Experiments & Demos



Test Bed Development

- Overall Goal/Objective:
  - Design and build test bed for verification and characterization of current, enhanced and next generation data links in support of the verification and demonstration of the 2007 Wx communications architecture.
- Implementation Mechanism:
  - In-house on-going effort, with completion of Phase I expected by end of FY00.
  - Supports Level IV Milestone 10 (3Q01)
- Technical Results to Date:
  - Identified data link performance parameters/requirements for evaluation
  - Developed a Phase I Test Bed Plan which provides a simulated environment for testing of the data links to be evaluated
  - Began implementation of the Test Bed Phase I Plan
- Future Plans:
  - Completion of Test Bed Phase I. Projected completion 4Q00.
  - Implementation and completion of Phase 2 of the test bed. Incorporates a satellite link simulator into the test bed providing full simulation of satellite systems. Projected completion 3Q01.

Test Bed Phase I

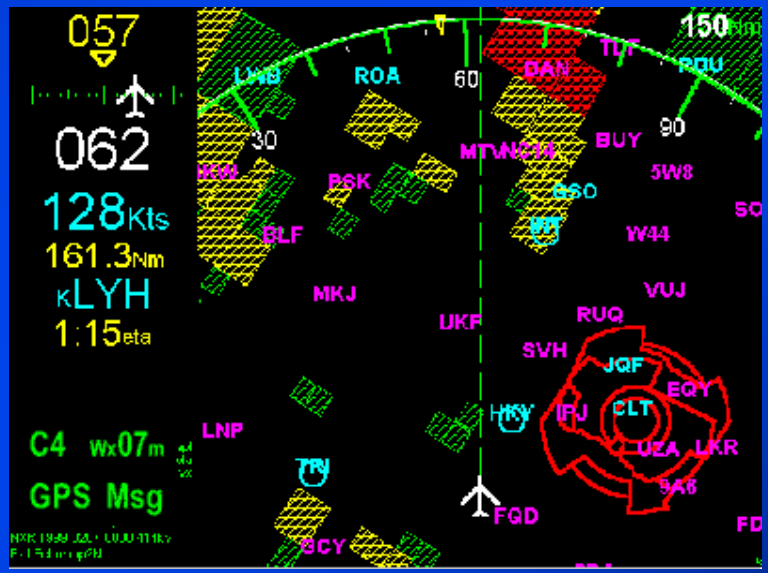


Current Technology Assessment

- Overall Goal/Objective:
  - Assess current comm datalink technologies and evaluate potential for the 2007 WINCOMM Architecture and associated requirements. To include evaluation, characterization and identification of any gaps for potential improvements/enhancements.
- Implementation Mechanism:
  - Ongoing in-house/external effort
  - Supports Level 4, Milestone 9, due 4Q00
  - Grant awarded to Ohio University for period 4/1/99 to 9/30/00
- Technical Results to Date:
  - Testing parameters identified and tests to be executed defined.
  - Initiated assessment/characterization of EchoFlight System. Projected completion date 3Q00.
  - Ohio University grant initiated for: (1) the analysis of Safe-Flight 21 datalinks (UAT, Mode S, VDLM4), and (2) flight experiments/characterizations of VDL Mode 2/3 data links. Projected completion date 4Q00.
- Future Plans:
  - Completion of the Ohio University Safe Flight 21 analysis and VDL Mode 2/3 flight assessments and characterizations. Projected completion date 4Q00.
  - Completion of EchoFlight assessment/characterization. Projected completion 3Q00.
  - Initiate and complete FISDL datalinks (ARNAV and Honeywell) assessment/characterizations.
  - Begin Evaluation of Enhanced WINCOMM Technologies, Level 4, Milestone 11, 3Q01.

EchoFlight/Orbcomm System Under Evaluation

EchoFlight/Orbcomm Data Communicator and Echo Flight software on a laptop computer.



EchoFlight/Orbcomm Sample EchoMap Image

Cessna fuselage mount antenna for the Echo Flight/Orbcomm System

Ohio University Grant

- Overall Goal/Objective:
  - Evaluate system-level performance characteristics of likely near-term weather datalinks, including Universal Access Transceiver (UAT), VHS digital link (VDL) Modes 2, 3, 4 and Mode S
- Implementation Mechanism:
  - University Grant tasked to:
    - Evaluate FAA Safe Flight 21/Ohio Valley datalink data with respect to aviation weather applications
    - Test and deliver a VDL Mode 2/3 air-ground datalink system suitable for aviation weather
  - Period of Performance: April 00 to September 00
  - Relevant milestone activity addresses: Assessment of Current Technology
- Technical Results to Date:
  - Review of Safe Flight 21 data has begun
  - VDL Mode 2/3 equipment is being ordered
- Future Plans:
  - Continue Safe Flight 21 data evaluation
  - Integrate and performance test VDL Mode 2/3 datalink system
  - Deliver VDL Mode 2/3 equipment to NASA for integrated comm system experiments/demos

Ohio University Grant

WxAP - Weather Information Communications

Ohio University Avionics Engineering Center

- Piper Saratoga

- VDL Mode 2/3 radio

Cooperative Research Efforts

- National Airline / Transport and World-Wide Weather Information Systems
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  - Honeywell — Weather Information Network (WINN)
  - Rockwell Collins — Satellite Weather Information System (SWIS)
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  - Honeywell — GA-Oriented VHF DataLink (VDL) Mode 2-Based Weather and Flight Information Services (FIS) Broadcast, Reception, and Display System
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  - NCAR — A Demonstration of an End-to-end Oceanic Weather Hazard Information Dissemination System
  - NRL — Ceiling and Visibility

Satellite Weather Information System (SWIS)

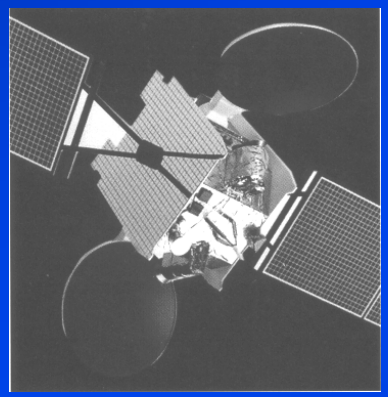
- Overall Goal/Objective:
  - Demonstration of cost effective satellite-based delivery of graphical weather information
- Implementation Mechanism:
  - Completion of 6 month Phase II demonstration period in May 2001
  - Addresses Level II (WxAP) Milestones 6, 7 and Level III (WINCOMM) Milestones 3, 4
  - Industry Partners: Rockwell Collins, Jeppeson, American Airlines, WorldSpace
- Technical Results to Date:
  - Phase I - Successful tests of GA aircraft reception of weather data broadcast via AfriStar satellite; Johannesburg, South Africa, September, 1999
  - Phase II - Successful launch of AsiaStar Satellite; satellite checkout underway
- Future Plans:
  - Antenna development, 3Q FY 00
  - Hardware development and certification, 1Q FY 01
  - Installation into two American 777's beginning November 2000
  - Begin 6 month demonstration/evaluation period December 2000

Satellite Weather Information System (SWIS)

Phase I

Graphical Weather Data Direct to the Cockpit via S-DARS.

Satellite Flight Test
Johannesburg, South Africa
September 20-24, 1999



AfriStar Satellite

Patch Antenna Mounted to Cessna 172

Internal Equipment (GPS, Laptop Computer, etc.)

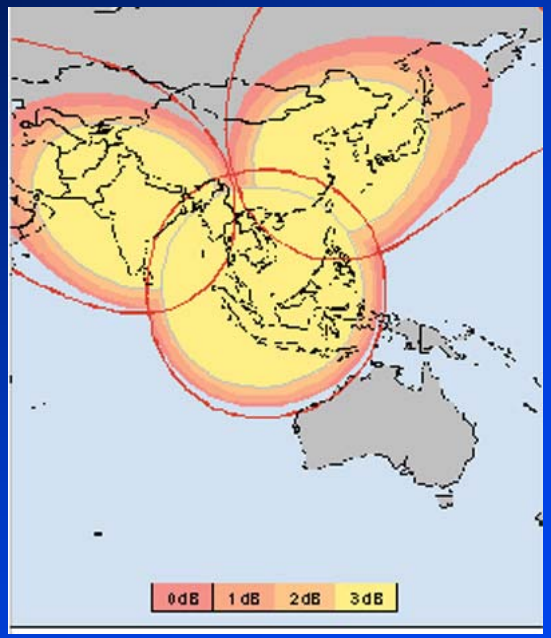
Flight test and evaluation of worldwide weather datalink capability using broadcast Satellite Digital Audio Radio Services (S-DARS).

Satellite Weather Information System (SWIS)

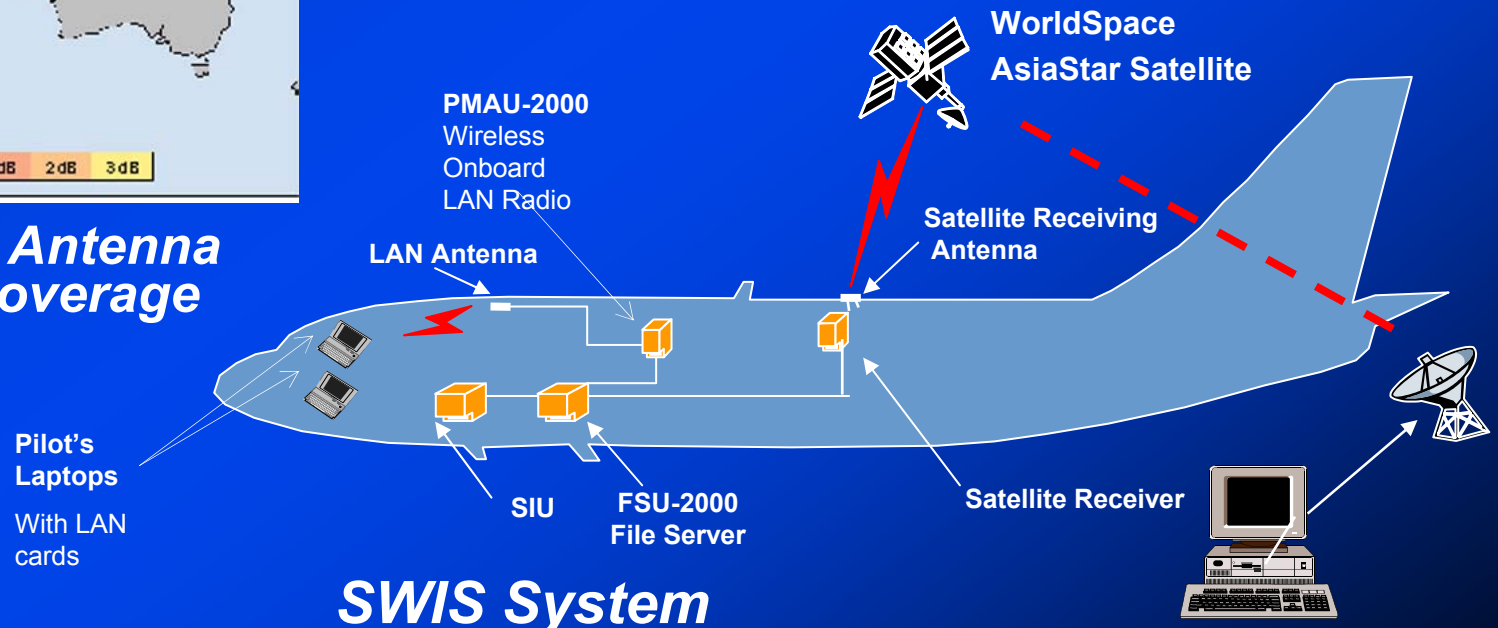
Phase II

Graphical Weather Data Direct to the Cockpit via Satellite Digital Audio Radio Service

Operational Evaluation: American Airlines Operational 777's Flying Chicago-Tokyo and Chicago-Hong Kong Routes Beginning December 2000

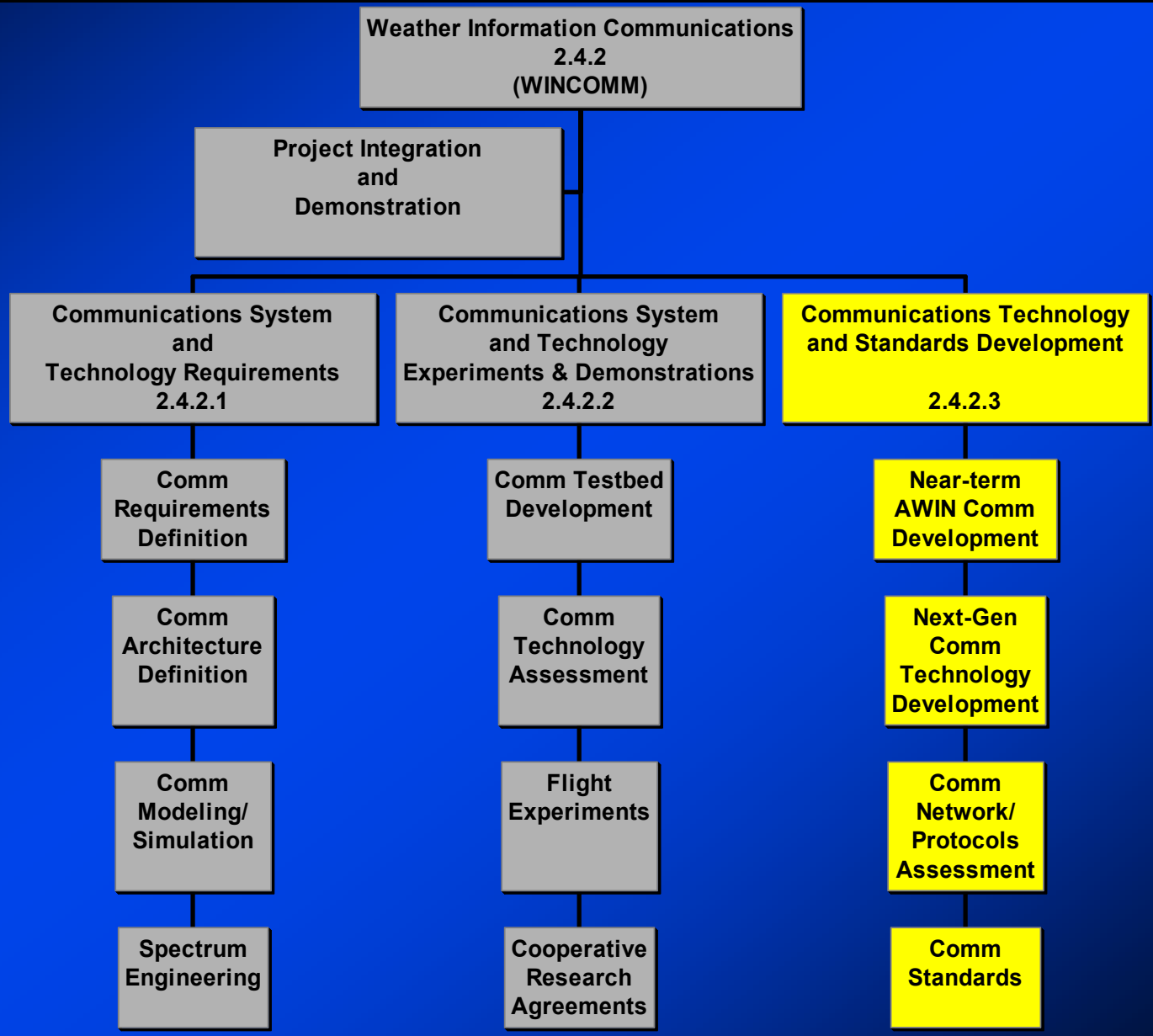


AsiaStar Antenna Beam Coverage



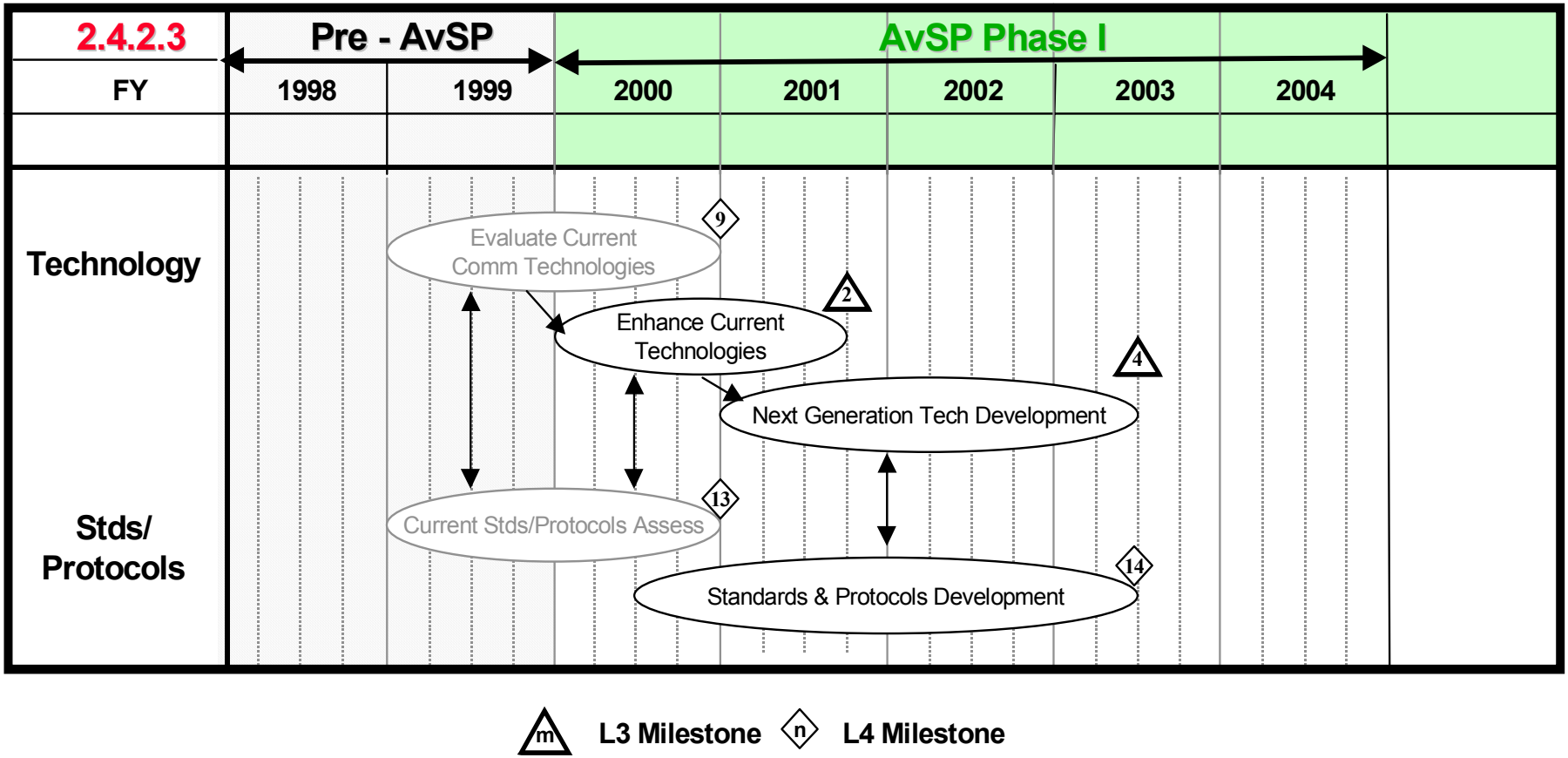
SWIS System Configuration

Work Breakdown Structure



Level IV Roadmap

2.4.2.3 Comm Technology and Standards Development



SWIS Antenna Technology Development

- Overall Goal/Objective:
  - To develop S-band circularly polarized antenna for SWIS flight experiments
- Implementation Mechanism (I/H):
  - Period of Performance: FY00 (12 months)
  - In-house:
    - Design, fabricate and test a dual CP S-band antenna
    - Assist industry partner (R/C) in performance eval of proprietary industry design
  - Other industry/government partners: NASA LaRC, Rockwell Collins
- Technical Results to Date:
  - Developed a L-band CP antenna design
  - Completed pattern and ANA measurement of a L-band RHCP antenna provided by Rockwell
  - Pattern and ANA measurements of a second L-band dual CP antenna provided by Rockwell currently in progress
  - Initiated the design of a S-band dual CP antenna
- Future Plans:
  - Complete in-house development of S-band dual CP antenna and verify performance

SWIS Antenna Technology Development

Far-field Facility

MMIC Characterization Facility

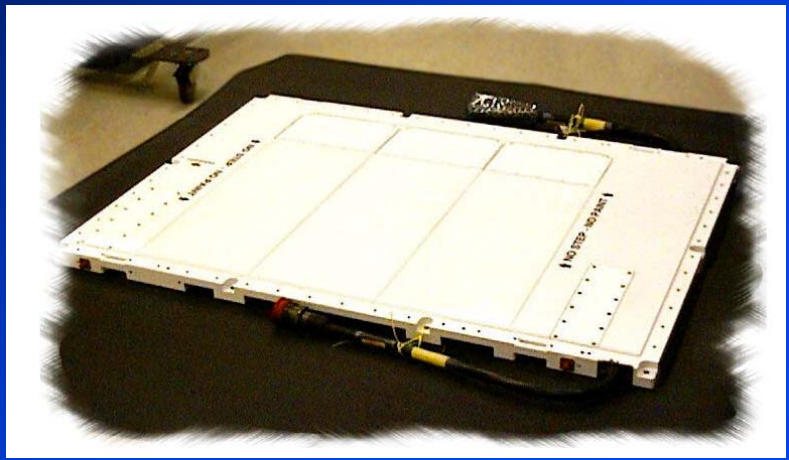
Near-field Facility

CD-90-48761

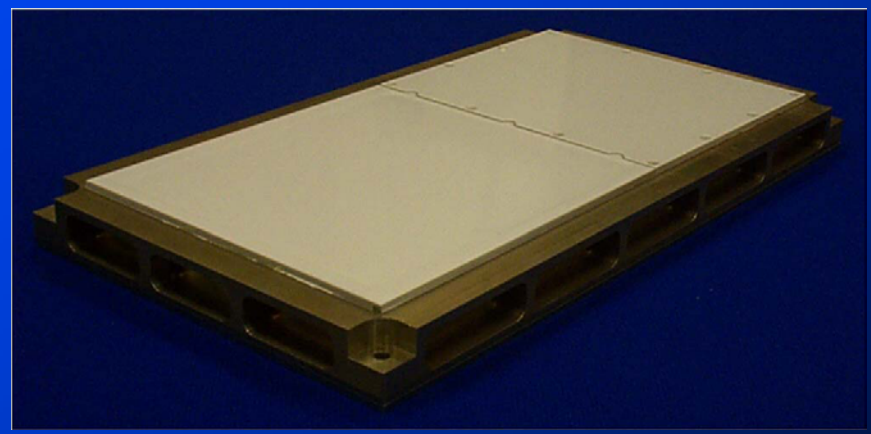
Broadband 2-way SATCOM

- Technology:
  - Broadband, 2-way satellite communications datalink terminal (developed under NASA AATT project)
  - Enabling technology for newly announced *Connexion by Boeing™* global communications system to provide passenger services, flight-specific, and crew information services
- Key Technical Features of Prototype Terminal:
  - High bandwidth:
    - over 2 Mbps to A/C (factor of 200 over current technology)
    - over 100 Kbps off A/C (factor of 10 over current technology)
  - Low profile, electronically steered phased array antennas
  - Innovative spread-spectrum modulation
- Industry Partners:
  - The Boeing Company (antenna and terminal development, joint experimentation); cost-shared activity
  - L3 Communications (modem), Kearfott (attitude system)
- Future Experiment Plans for Technology:
  - AATT: Evaluation for ATM/Free Flight applications
  - WINCOMM: Evaluation for Wx information distribution

Enabling Antenna Technology



Ku-Band Receive
Phased Array Antenna



Ku-Band Transmit
Phased Array Antenna

Broadband Terminal

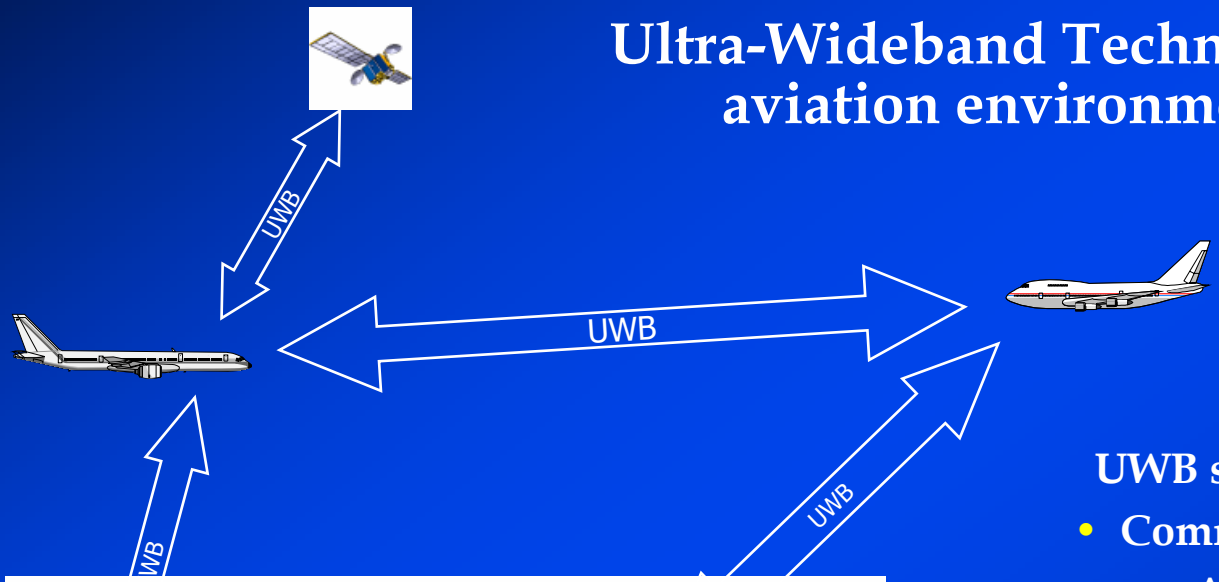
Ground-mobile SATCOM Platform

Ku-Band SATCOM Terminal & Test Equipment

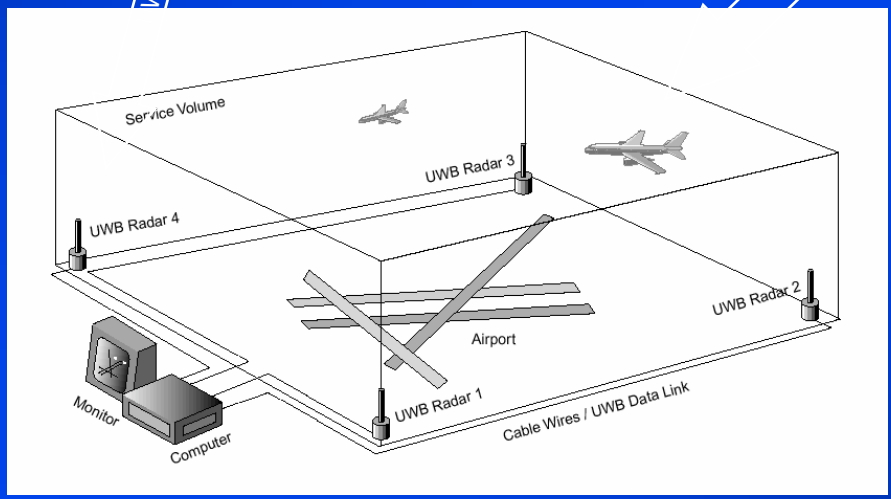
Ultra-Wideband (UWB) Technology for Aircraft Data Communications

- Overall Objectives:
  - Investigate feasibility of UWB communications technology for the aviation environment and Wx information dissemination
  - Foster improved government understanding of UWB technology.
- Implementation, January 2000 to September 2001:
  - Task includes two parallel activities:
    - Assistance with government testing of UWB technology, through partnership with the FAA, FCC, NTIA, NIST and with industry support
    - UWB technology study, feasibility analysis, and optional technology demonstrations focused at the aviation environment/application
- Technical Results to Date:
  - 02/00 – Initiated technical study phase (in-house)
  - 04/00 – Began collaborative work with other government agencies to test UWB
  - 05/00 – Completed Volpe study of aviation CNS applications of UWB
- Selected Future Milestones:
  - 10/00 – Complete testing of UWB with other government agencies
  - 09/01 – Flight test benefits of UWB for aviation Wx communications

Ultra-Wideband (UWB) Technology for Aircraft Data Communications



Ultra-Wideband Technology may benefit aviation environments in many ways



"Radar box" courtesy of **US DOT, Volpe National Transportation System Center**

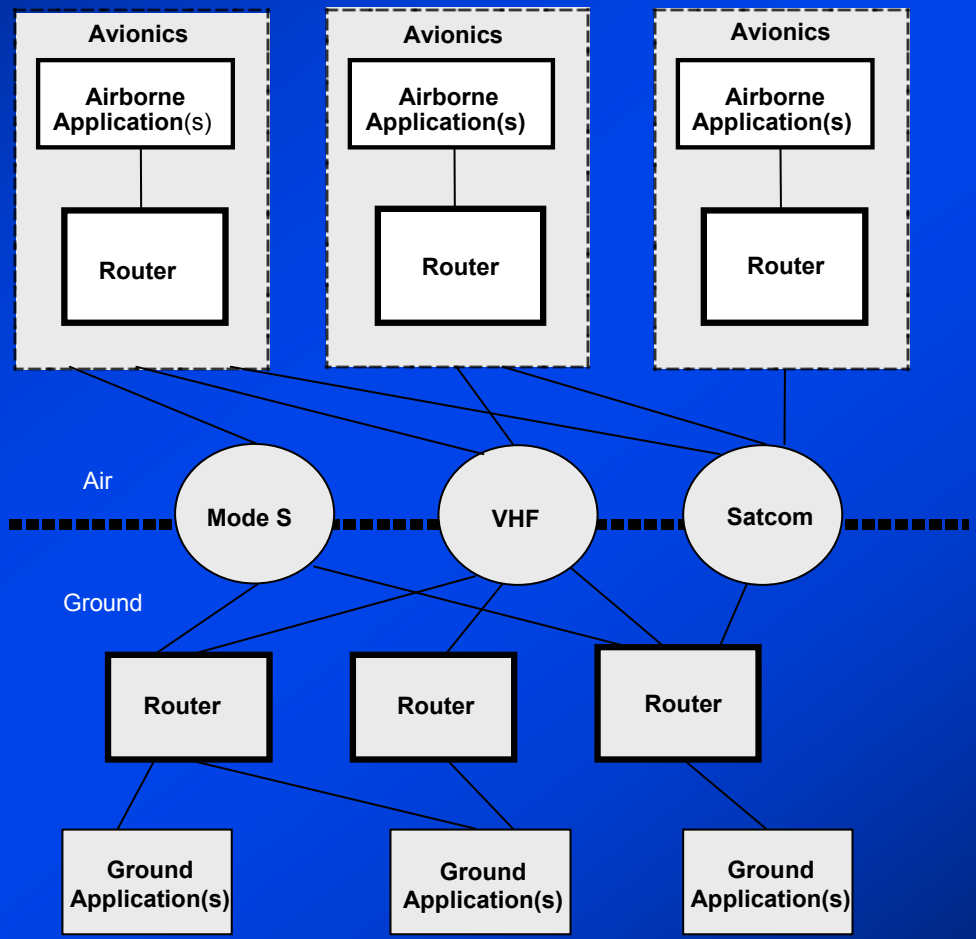
UWB shows potential for:

- Communications
  - Aircraft/Terminal
  - Aircraft/Aircraft
  - Aircraft/Satellite
  - Onboard Wireless LANs
- Radar (not WINCOMM focus):
  - Collision Avoidance
  - Downdraft/Turbulence detection
  - Airport Surveillance

Network Protocols Development

- Overall Goal/Objective:
  - Assess current network protocols and standards for Wx dissemination. Identify and develop open standards and protocols in support of the 2007 WINCOMM architecture and its associated supporting technology elements.
- Implementation Mechanism:
  - Period of Performance: 1Q99 through 2Q03
  - Relevant milestone(s) activity addresses:
    - Assess current comm standards and protocols (I/H) (4Q00)
    - Near term and next generation comm standards and protocols development (I/H and contract) (2Q03)
  - Industry/government partners: MIT/Lincoln Labs, Computer Networks & Software, Inc.
- Technical Results to Date:
  - MIT/LL: Proposal to use TCP/IP based protocol for weather information distribution (4Q99)
  - CNS: Aeronautical Related Applications using ATN and TCP/IP (4Q99)
- Future Plans:
  - Complete procurement of ATN routers and Mobile IP hardware in support of system experiments and demonstrations
  - Integrate ATN router and Mobile IP hardware into laboratory testbeds

Network Protocols Development

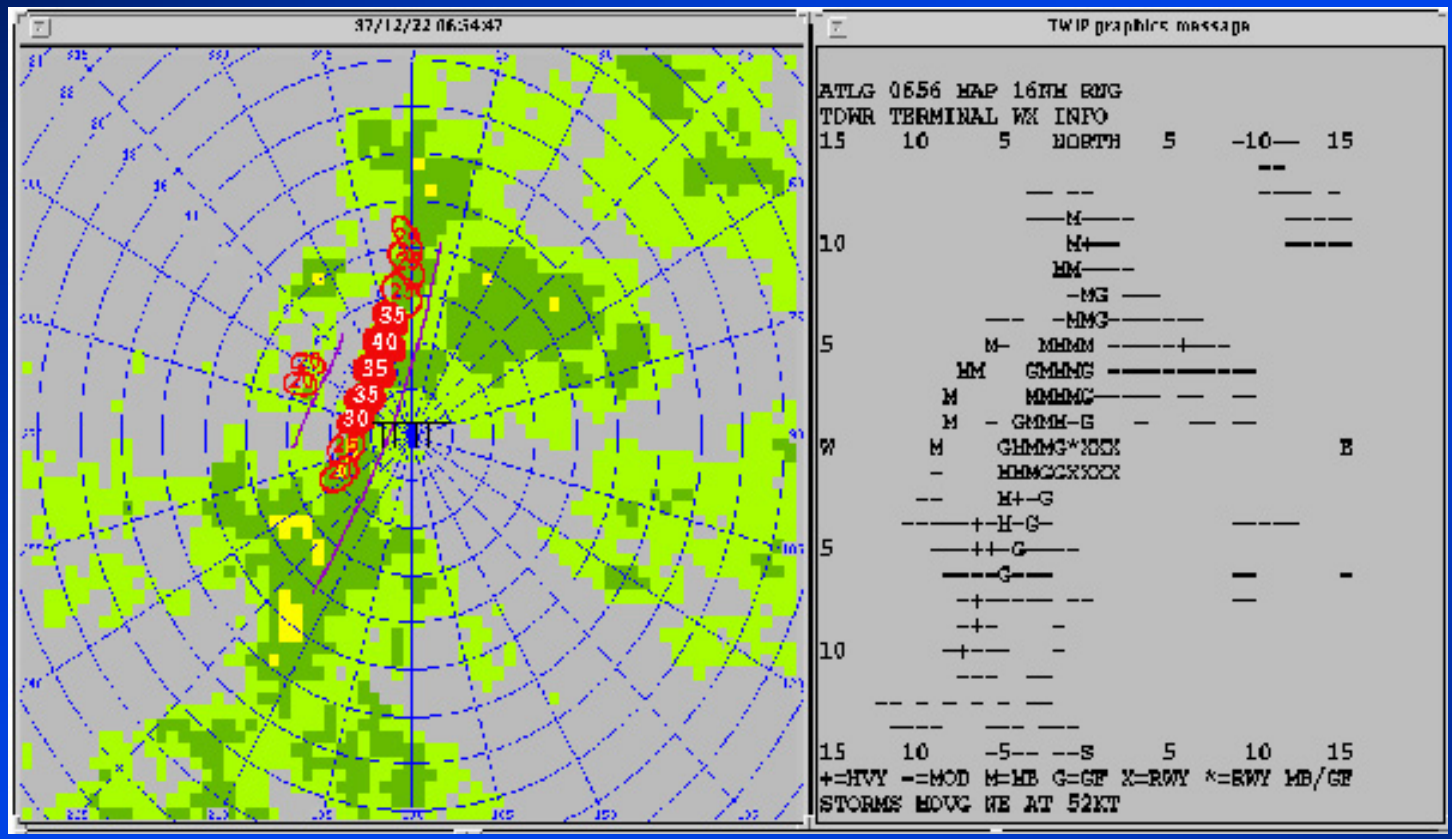


Network Routing Connectivity

Weather Information Format Standards

- Overall Goal/Objective:
  - To investigate and identify optimal format standards for aviation weather information in support of interoperability
- Implementation Mechanism:
  - Period of Performance: 1Q00 - 4Q02
  - Relevant milestone(s) activity addresses:
    - Assess current comm standards and protocols (I/H) (4Q00)
    - Near term and next generation comm standards and protocols development (I/H and contract) (2Q03)
  - Other industry/government partners: MIT/LL
- Technical Results to Date:
  - MIT/Lincoln Labs: Issues in the Development of an Open Standard for Data Link of Aviation Weather Information (4Q99)
  - Developing process (jointly with AWIN) to identify the optimal format for AWIN
- Future Plans:
  - Develop and advocate consistent data format standard for AWIN data exchange

Weather Information Format Standards



Iconic ASCII

Representation of Microbursts and Storm Front

Summary

- Communications Requirements and Architecture Definition:
  - Weather Information Communications Requirements Definition
  - Weather Communications System Architecture Definition (2007 & 2015)
  - Advanced Communications Modeling and Simulation Capabilities in Support of Requirements and Architecture Analysis and Validation
- Communications Experiments and Demonstrations:
  - Communications Testbed Development for Technology Validation
  - Augmented with Contracts, Grants and Cooperative Research Agreements with Industry and Academia for Comprehensive Integrated System Solution
    - Current Comm Technology Assessment for Wx Dissemination
    - Near Term Technology Experiment Validation via In-House & Industry CRAs
- Technology and Standards Development:
  - Focused High Impact Technology Development in Support of Communications Requirements and Architecture
  - Open Standards, Formats and Network Protocols Definition for Seamless Interoperability

Backup Charts

FAA Coordination